# Compressed Air Magazine

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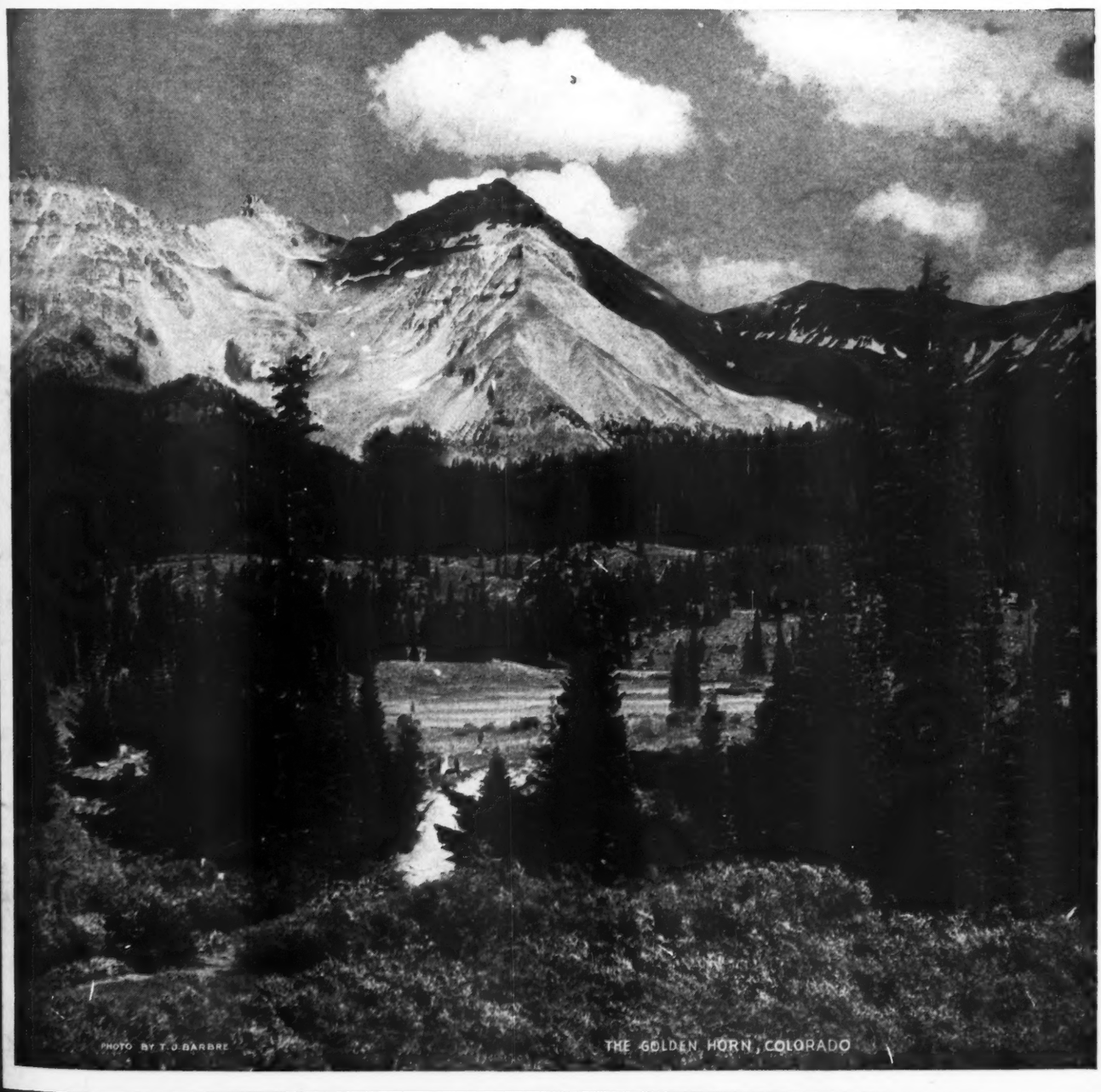

PHOTO BY T. J. BARBRE

THE GOLDEN HORN, COLORADO

# MODERNIZE YOUR BELTE COMPRESSOR

## ROCKWOOD *automatic belt tightening* MOTOR BASES

### ELIMINATES MAINTENANCE —IMPROVES PERFORMANCE

A large manufacturer in New Jersey had continuous trouble with the idler drive on this 125 h.p. motor, as the idler brackets would break causing considerable shut downs. They installed Rockwood automatic belt tightening motor bases under the motor and exciter and since then maintenance of productions has been continuous—without any interruption—and they are enthusiastic about the drive.

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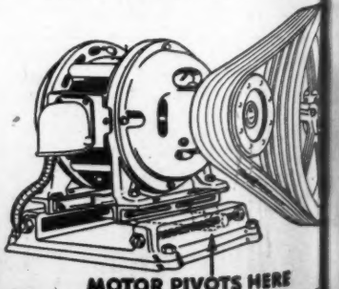

**MOTOR PIVOTS HERE**

*You need Rockwood Motor Bases with V just as with flat belts. They give you long for the belts- and help you save rubber by your present V-belts last longer.*

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*Indianapolis, Indiana*

ROCKWOOD V-BELTS AND V-SHEAVES

ROCKWOOD PIVOTED MOTOR BASES

ROCKWOOD PAPER PULLEYS

### ON THE COVER

WORLD travelers are agreed that the little-visited San Juan region of Southwestern Colorado contains some of the finest mountain scenery on earth. Our cover picture shows a peak in the San Miguel Range. It is known as the Golden Horn and is one of the landmarks of the area.

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### IN THIS ISSUE

WHEN the Tennessee Valley Authority was set up in 1933, the nation was at peace, but there were, nevertheless, some individuals who considered the plan to develop the Tennessee River a defense measure. Regardless of how its proponents envisioned it in the beginning, there is no mistaking that the TVA is right now a valuable asset in our war-preparation program. Money, in itself, will not win wars. To be useful it must be converted into production facilities, and one of the foremost of these is electrical kilowatts. The TVA is already pouring out a vast flood of power that is serving to make vitally needed materials such as aluminum, and it has underway a gigantic construction program that will greatly increase the production of electric energy. Our leading article summarizes recent and current TVA activities.

•

THE Erie Canal was rightfully considered a huge undertaking at the time it was being built. It played an important part in the colonization of the Midwest, and established an agricultural economy that remains important today. The reconstructed and enlarged canal lacks some of the glamor of the old one, but it is a more efficient artery of transportation. The history of the original waterway and a description of its conversion into the present canal system are contained in our second article.

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STANDARDIZATION of containers is a subject of prime interest right now. Some of the many angles that must be considered in any intelligent effort to accomplish the desired results are presented in *Can We Standardize Containers?*

•

SHELL interests have recently put in operation a relatively short but important pipe line to handle crude oil on the West Coast. Its construction was characterized by the speed that has become traditional with such operations. The line and its associate pumpings stations are described in a 2-page article.


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### EDITORIAL CONTENTS



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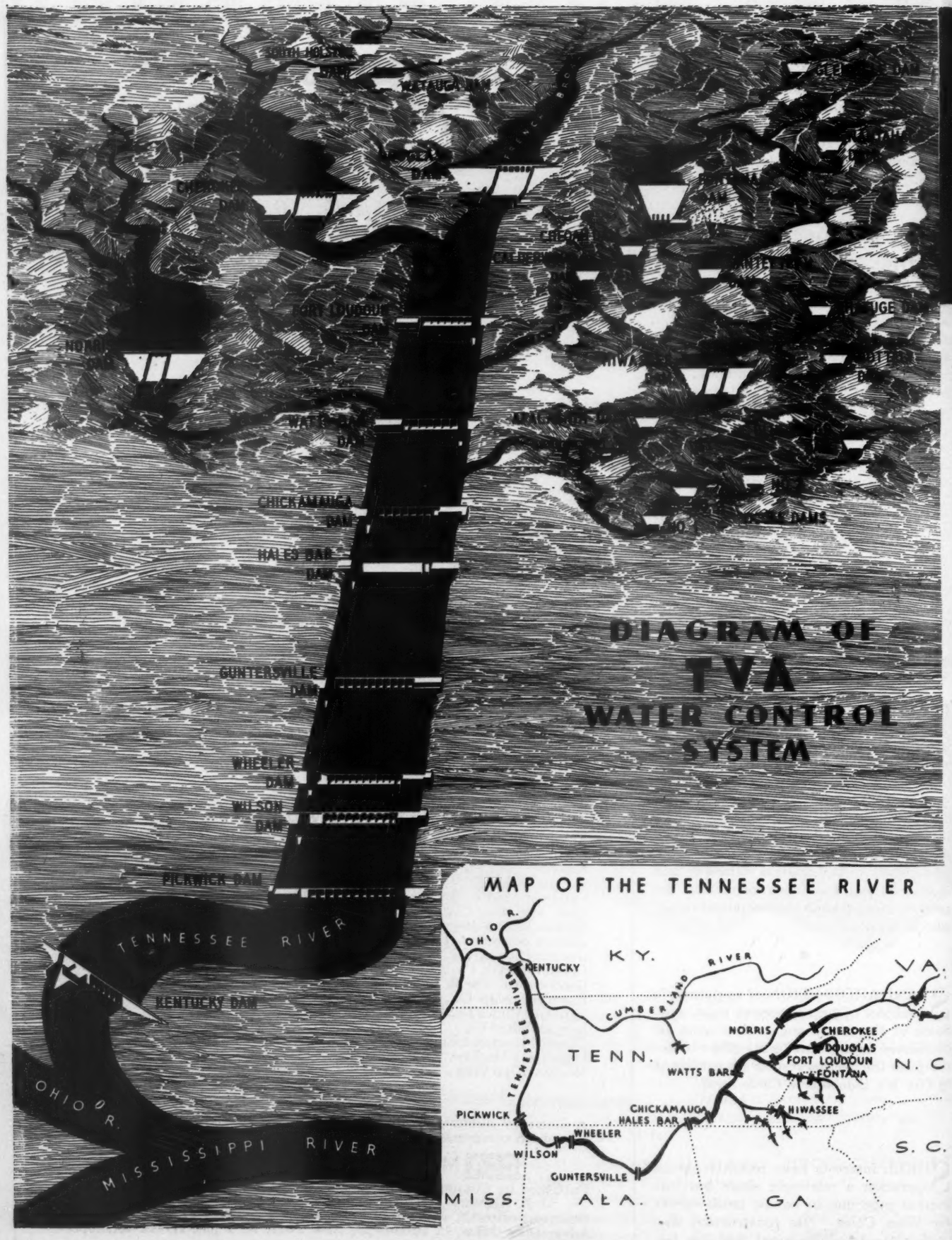
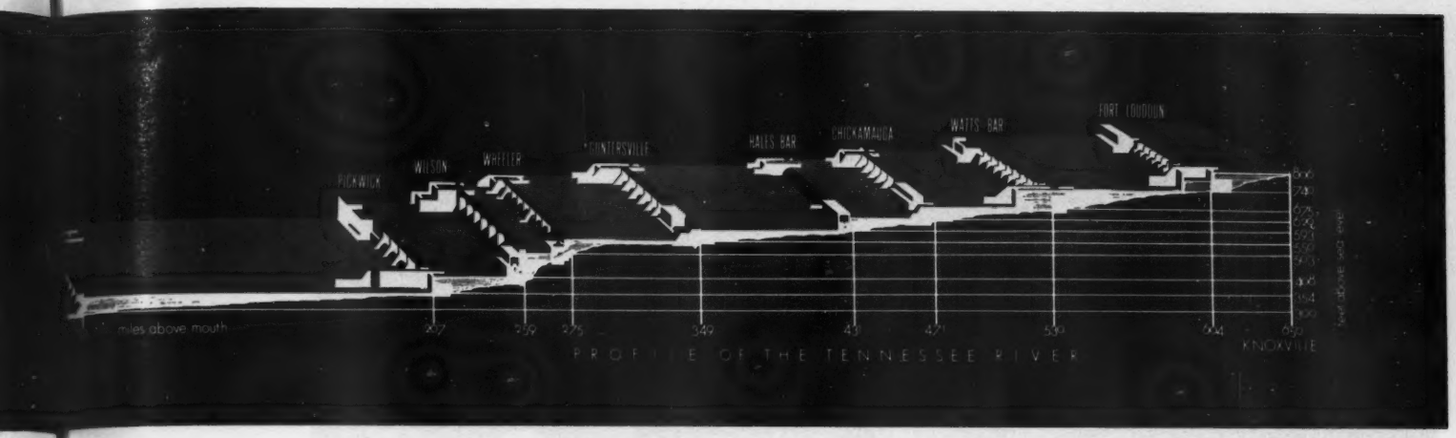



**THE TVA CHAIN OF DAMS**

At the conclusion of the current construction program, the TVA will have in operation the 28 dams shown above. Two on the main river and eight on tributaries were taken over from other agencies, while the others are TVA projects. The drawing shows how the system will make multiple use of the water for power generation.




**REGIMENTING THE TENNESSEE**

**The Tennessee, sixth largest river in the United States, drops 506 feet between Knoxville, Tenn., and Paducah, Ky., where it joins the Ohio. Formerly it ran untamed, periodically flooded cities and farmlands, and dissipated its great energy in destructive fashion. By means of the nine dams indicated here it is being transformed into ten placid pools. Corollary dams on the tributaries permit regulating the flow to obtain the maximum benefits of power generation, navigation, and flood control. Of the main-river dams six are completed. Of the three still under construction Watts Bar is virtually finished, and Kentucky and Fort Loudoun are well advanced.**

# TVA's Wartime Program

*C. H. Vivian*

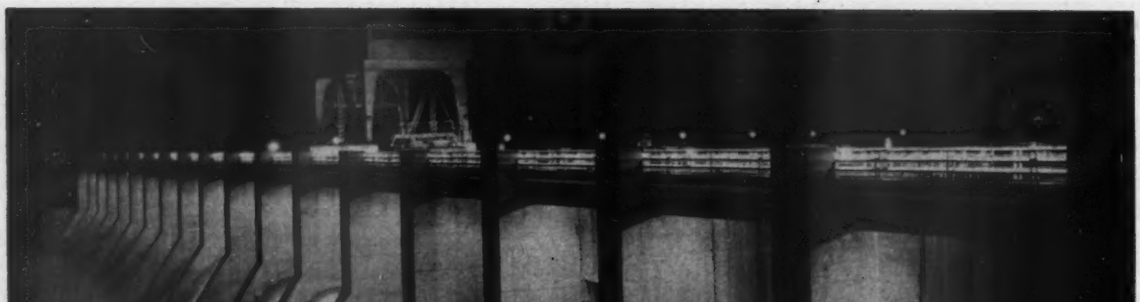
THE Tennessee Valley Authority is carrying on the largest construction program ever undertaken in the United States. While its primary purpose is to make available more electrical energy for use by industrial plants engaged in manufacturing war materials, it will at the same time contribute towards the fulfillment of the broad aims of the TVA: to improve navigation and to control floods in the Tennessee River, as well as to advance the economic and social welfare of the 2,000,000 persons that reside in the Tennessee Valley. Although none of its individual structures will be so large as Boulder, Shasta, or Grand Coulee dams in the West, the aggregate cost of the work now in progress will far exceed the outlay for any one of the latter and even be greater than that for the Panama Canal. The current program includes the rearing of twelve dams on the Tennessee and its tributaries, building one new steam-generating plant and adding to an existing one, and increasing the capacity of various main-river hydroelectrics stations previously constructed.

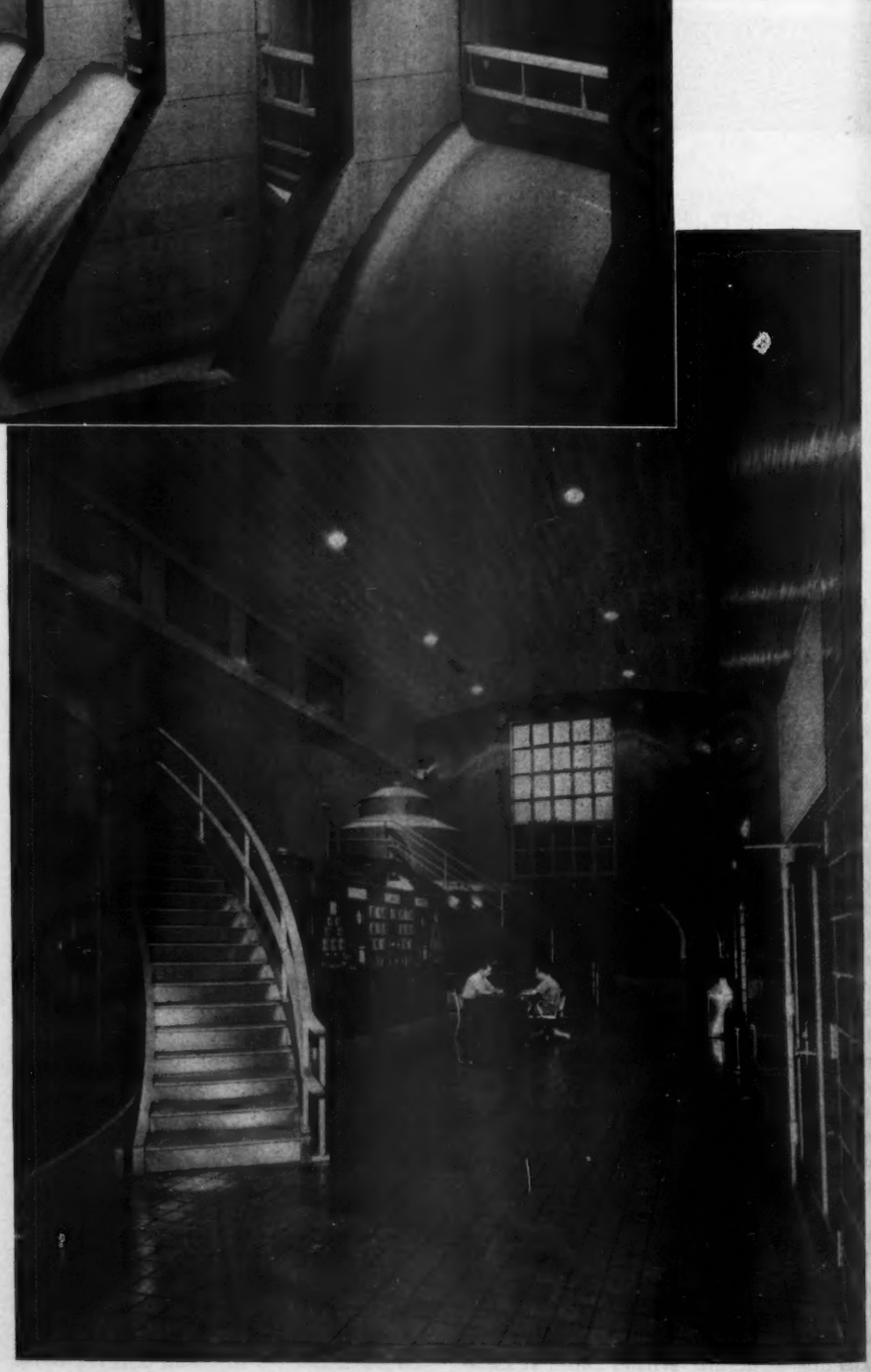
Just as the first World War produced the initial government-built dam on the Tennessee and gave birth to the TVA movement, the present conflict is serving to speed its development beyond the most optimistic estimates of its progenitors. The first structure, Wilson Dam, at Muscle Shoals, Ala., came into being because the War Department sought a location suitable for the generation of power for use in extracting nitrogen from the air for the manufacture of explosives. Its construction led to study of the power-generation and navigation potentialities of the river that took ten years and involved an expenditure of more than $1,100,000. Those investigations culminated in a 734-page report transmitted to Congress in 1930 by the U.S. Engineers. The report contained preliminary engineering data and cost figures covering a series of dams, locks, and appurtenant structures that would provide a 9-foot channel throughout the 650-mile stretch of the Tennessee from its mouth to Knoxville and a 6-foot channel for considerable distances up all its principal tributaries. Various possible schemes for developing power in conjunction with the dams were presented, and 149 possible locations of hydroelectric stations were specified. It was estimated that, by throwing up dams to equalize the flow of the river, as much as 3,000,000 kw. of electrical energy could be continually generated at a cost of 4½ mills per kilowatt-hour. The total cost of all this was placed at $1,200,000,000.

When the Tennessee Valley Authority was created in 1933, it fell heir to that development plan and also took over the operation of Wilson Dam and the associate structures that had been erected there during and following the war. It was given a $50,000,000 appropriation by Congress with which to start work on two additional dams: Norris, on the Clinch River, 28 miles from Knoxville, and Wheeler, on the Tennessee, at the head of slack water formed by Wilson Dam. In reporting upon its first year of activities, the Authority outlined a 5-year plan calling for the construction of four more dams, two on the main river and two on tributary streams. This program was in line with the War Department's original scheme of creating run-of-the-river power plants on the Tennessee and storage dams on the tributaries which would impound water during seasons of high flow and release it during seasons of low flow to insure sustained generation of power at the downstream stations. The projected expenditures for these structures and for the other activities of the agency during the 5-year period were $260,000,000.

The visualizers of the TVA movement expected that this program, which would carry through until the summer of 1939, would provide all the power that could be absorbed in the area for the time being, and it was the general belief that further increases in generating capacity would have to await the demands that would gradually grow with the accelerated economic development resulting from the program. Pursuant to this general (although slightly altered) plan, construction was started during 1935 and 1936 on Pickwick Landing, Guntersville, and Chickamauga dams on the Tennessee and on Hiwassee Dam on the river of the same name. The first power was generated at Pickwick Landing Dam in June, 1938, at Guntersville in August, 1939, at Chickamauga in March, 1940, and at Hiwassee in May, 1940.

Even while these works were in progress, the area served was increasing its consumption of electricity faster than had originally been estimated, and it became evident that still more generating capacity would be required in the near future. Accordingly, three additional main-river dams were authorized and placed under construction: Kentucky, near the confluence of the Tennessee and the Ohio,





in July, 1938; Watts Bar, 530 miles above the mouth, in July, 1939; and Fort Loudoun, 604 miles above the mouth, in July, 1940. The completion of these, together with the structures previously placed on the river, will provide the Tennessee with a continuous 9-foot navigation channel all the way to Knoxville, as was projected in the 1930 report of the U.S. Engineers.

It will thus be seen that the TVA, at the time the country began actively to prepare for war, was doing considerable dam-building as a result of the normal unfolding of its long-range peacetime development. On top of this came the current expansion program and, concurrently, a decided quickening of the pace of the work already underway. Although the national emergency was primarily responsible for these movements, a secondary but none the less important motivating influence was the abnormally dry year of 1940 that seriously decreased the flow of the river. Despite the drought, which was severe, but not the worst on record, the TVA was able to fulfill all its existing contracts for electricity because the estimates of firm-power generation had been based on the lowest-known flow of the stream. However, under pressure of the Government to increase its production of aluminum, the Aluminum Company of America added to its already extensive plants at Alcoa near Knoxville and requested more power. At that time the corporation was taking 30,000 kw. of firm power from the TVA under a long-term contract, in addition to using the full output of its own three hydroelectric stations on tributaries of the Tennessee.

To meet the demand, as well a that of

**POWER**

**At the top is a night view of Chickamauga Dam, with water being released through all the spillway gates. Above is shown the generator room at Guntersville Dam. This is a typical example of the attractive architectural treatment that has been given to the interiors of all the TVA stations. In normal times the dams are open to inspection by the public, but for the duration of the war visitors are excluded from the generator rooms.**

various other established industries in the valley that were taking on contracts for war materials and of new ones that were starting up, the TVA acquired generating and distributing facilities from the Tennessee Electric Power Company. By utilizing these and by bringing in power through interconnections with privately owned plants, it was able to satisfy the needs of all its customers. During the year ending June 30, 1940, the Authority's generating capacity was increased by 80 per cent to 958,000 kw. Of the gain of 423,000 kw., 238,000 represented plants taken over and 185,000 new units installed at Guntersville, Chickamauga, and Hiwassee dams during the year. Total production of energy in the fiscal year was 4,113,000,000 kw-hrs., or more than double that of the preceding year. By acquisition and construction, the transmission lines were increased by 2,500 miles during the year, bringing the total to 4,609 miles. The number of transmission substations rose from 112 to 231.

By this time it had become apparent that still greater demands for power would be made on the system as a result of the quickened tempo of the war preparations. To provide facilities to meet these requirements, work was started on August 1, 1940, on expansions that had previously been authorized by Congress and that were designed to augment the generating capacity by 300,000 kw. The program called for the building of Cherokee Dam on the Holston River, the erection of a 120,000-kw. steam-generating plant at Watts Bar Dam, and the addition of two 26,000-kw. generators at Wilson Dam and one 36,000-kw. unit at Pickwick Landing Dam. In authorizing these facilities, Congress acted upon the recommendation of the Council of National Defense that they were urgently needed to furnish power for the greatly expanded national-defense production in the Tennessee Valley, including large quantities of aluminum for airplanes.

Even before these projects got underway, a second emergency construction program aimed at further increasing the output by 216,000 kw. had been favorably acted upon in Washington. This provided for the building of four dams on the Hiwassee River and its tributaries. These are known as the Hiwassee Projects, of which the individual units are the Apalachia, Ocoee No. 3, Chautuge, and Nottely dams. The first two will include power-generating equipment, while the other two will serve only as water-storage structures.

On August 15, 1941, the TVA announced that it had acquired from the Aluminum Company of America the Fontana Dam site on the Little Tennessee River and would erect a dam there as soon as Congress voted funds. It also made public a contract which stipulates that, as soon as the reservoir behind Fontana Dam is filled, the TVA will take over the operation of five dams and power plants constructed by the Aluminum Company on the Little Tennessee and its tributaries. Three of these—Cheoah, Calderwood, and Santeetlah—are downstream from the Fontana site and will consequently benefit by the water that will be impounded by Fontana Dam. In return for the site the TVA agrees to build the dam and to waive any claim it might have under the Federal Water Power Act for compensation for benefits accruing to the Aluminum Company. The two other dams are the Nantahala and the Glenville, which have recently been completed. Ownership of the dams and hydroelectric stations will remain with the company. The contract was consummated after several years of joint study by the TVA and Aluminum Company looking towards the coördination of their facilities. The investigations established that maximum power production and maximum benefits of flood control could not be ob-

**RECREATION**

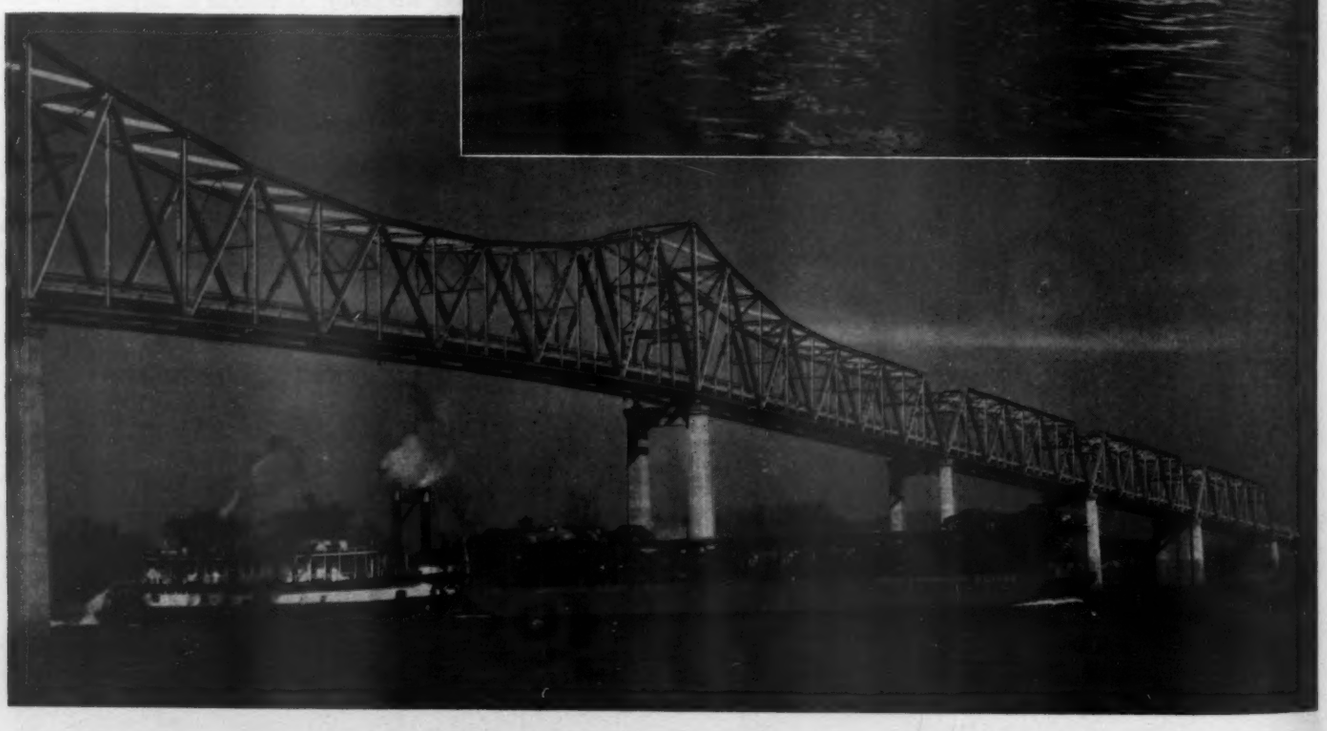
Young and old alike take advantage of the many opportunities for healthful outdoor enjoyment that are afforded by the chain of beautiful lakes created by the engineers. The TVA has made extensive studies looking towards maximum utilization of the recreational potentialities of the system and is co-operating with various national and state organizations to further that policy. In addition to boating and swimming, fishing is encouraged, and hatcheries run by the Authority are helping to stock the waters. It is estimated that 4,750,000 pounds of fish was taken from five TVA reservoirs in 1940. The picture below was taken at Pickwick Reservoir.

tained through the independent operation of the two systems and that unified operation would make available considerable additional power.

Fontana Dam was formally authorized on December 18, 1941, when President Roosevelt signed an act appropriating $10,000,000,000 for national-defense efforts. This bill also carries funds for starting work on two additional dams, the South Holston, on the South Fork of the Holston River, and the Watauga on the Watauga River. Further, money was provided for the placing of a fourth turbine in the Watts Bar steam plant. This is the second increase for the latter since construction on it began in the fall of 1940, and will double the installation initially planned for it.

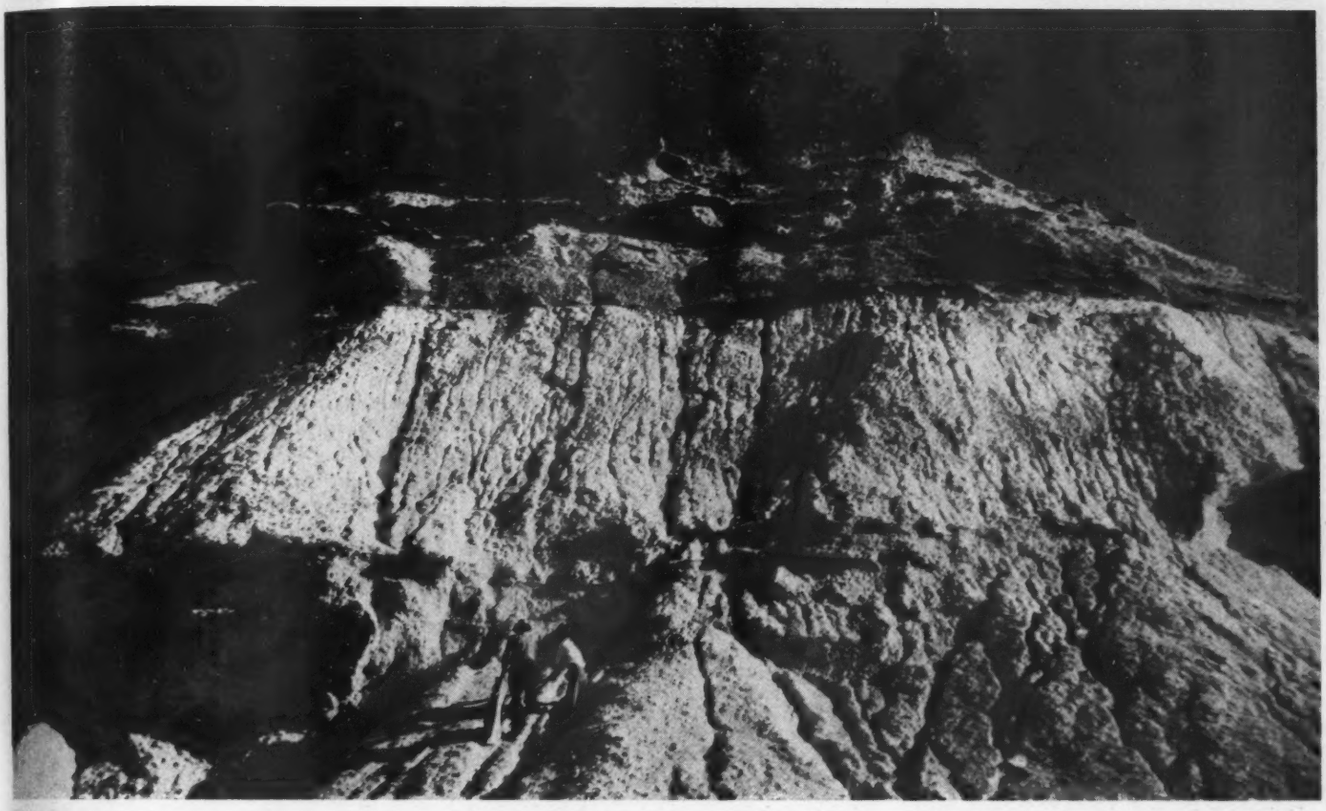
On January 30, 1942, the TVA embarked upon still another job of dam building—on Douglas Dam at a point on the French Broad River 32 miles upstream from its junction with the Little Tennessee near Knoxville. This brings to an even dozen the number of dams now underway and marks the ninth structure of its kind to be initiated as a national-defense project. Of the twelve, all but two will have associate hydroelectric stations. The exceptions, Nottely and Chautuge, will, as has already been mentioned, serve as water-storage structures at present, but provision will be made for the installation of generators. It should be noted in this connection that all nine of the dams that are being erected on tributaries of the Tennessee will impound water during the wet season for release during the dry months to help maintain power production in all the downstream plants. Consequently, they will contribute considerably more power to the system as a whole than is represented by the output of their generators. In other words, as more dams are built on the feeder streams, more generators are placed in the powerhouses of the run-of-the-river dams.

This huge construction program will, upon its completion, bring the installed generating capacity of the TVA system to 2,825,600 kw. Just how large a block of power this is can be grasped by comparing it with the 1,144,462 kw. available on December 31, 1941, in all the plants being operated under the jurisdiction of the U.S. Bureau of Reclamation, including Boulder Dam. Of the TVA total, it is estimated



**WATER TRANSPORTATION**

When the three main-river dams now under construction are completed and certain shallow areas near the headwaters of some of the reservoirs are dredged, a channel of 9 feet minimum depth will be available from the Ohio River to Knoxville, a distance of 650 miles. Meanwhile, there is a 6½-foot channel above Chattanooga, and the TVA is co-operating with the U.S. Army Engineers and the U.S. Coast Guard to improve it and to establish navigation aids. Estimated commercial traffic on this waterway in 1941 was 100,000,000 ton-miles, or nearly five times the 1933 volume. Petroleum products, grain, pig iron, and automobiles were the leading cargoes. The pictures show a bargeload of new automobiles passing under a bridge across Guntersville Lake and the stern-wheel passenger packet "Golden Eagle," which plies between St. Louis and Chattanooga.



**ALUMINUM**

The aluminum produced in this country comes largely from bauxite, much of which is imported. In an effort to develop a practical process for extracting the alumina from the clays that abound in the Tennessee Valley, the Authority has conducted extensive researches at its Muscle Shoals laboratory. Success has been attained in pilot-plant operations, and the erection of a larger plant is being considered. An attempt is also being made to develop a process for producing magnesium from olivine-bearing rocks of which more than 1,000,000,000 tons are available in North Carolina and Georgia. The picture shows an eroded area of clay soil near Muscle Shoals, Ala.

that more than 1,500,000 kw. will be available by the end of 1942. This will represent an increase in excess of 500,000 kw. in eighteen months.

In addition to the demands of large customers, the TVA is being called upon to serve various lesser but important defense industries, and its municipal and rural loads are increasing continually. It is significant to note that approximately one Tennessee farm in six is now electrified, as contrasted with one in 28 when the TVA was created nine years ago. Total net generation of power by the system in the year ending June 30, 1941, was 5,556,000,000 kw-hrs., an increase of 37.4 per cent over the preceding year. The average residential consumer paid 2.06 cents per kw-hr. for his current, as compared with 3.79 cents in the country as a whole. Small commercial customers paid an average of 2.18 cents, and industrial customers, who bought 60 per cent of all the energy sold, paid an average of 0.77 cent. Power revenues for the year aggregated $21,137,371. The total average investment charged to power facilities was $185,000,000, on a depreciated basis. The net return from power sales, before depreciation, was $11,873,129.

The cost of the present construction program will exceed $300,000,000. More than 30,000 persons are employed on it, and the peak is yet to be reached. The work is considered of such importance by the Government that it has been given full defense status, with priorities for all materials required. In accordance with its usual policy, the TVA staff has designed all the structures involved and, with one exception, is building them with its own forces. A deviation from the established procedure is being made in the case of a tunnel in connection with the Ocoee No. 3 Dam, which is being erected on the Ocoee River upstream from two dams purchased from the Tennessee Electric Power Company. Tunneling is also a part of the Apalachia Dam project and the Authority is doing that work itself. The Ocoee contract was let to afford a basis of comparing costs, which the Authority considered desirable in view of the fact that it has had no previous experience in driving tunnels.

It need hardly be stated that speed of construction is being emphasized. Accordingly, the maximum number of men that can be used efficiently is on each job, and operations proceed around the clock six days a week. On Sundays a skeleton force does the necessary maintenance and repair work on machinery and equipment. In the past it has been a TVA policy to schedule dam-building so that the engineering staffs and the mechanical equipment could be employed progressively and kept busy continually, thereby making for efficiency and economy of construction. Today, with the volume of work so vastly increased, it is not feasible to practice this rotation to the same degree, but, nevertheless, it is being done to a considerable extent.

For example, Douglas Dam, the latest one to be undertaken and well along towards completion, is almost identical with Cherokee Dam, and it has been possible to transfer much of the engineering organization and equipment from the latter to the new project. As a result of these favorable circumstances, Douglas Dam is the fastest dam-building job on the Authority's schedule to date. Although a 5-mile railway and 7 miles of highway had to be built to give access to the site, the completion date has been set for December 1, 1942, which allows only ten months to erect a concrete barrier 150 feet high and 760 feet long and ten auxiliary small earth dikes, as well as to clear a reservoir area that extends 40 miles up the French Broad River and covers 30,500 acres. In an effort to meet the deadline imposed, and thus utilize the dam for storage of the heavy rainfall of next winter and spring, a force of 5,000 men has been put to work.

**AGRICULTURE**

Misuse and despoliation of the land during past generations greatly reduced the productiveness of the Tennessee Valley, and one of the stated objectives of the TVA is to aid in its restoration. This is being done in countless ways, ranging from reforestation to assisting farmers in all phases of their work. Some of these efforts, such as the development and testing of fertilizers, are also improving crop-growing practices in other parts of the country. This picture shows a load of cotton.

It is not possible in an article of this length to present full details of the TVA wartime construction program. Another one will be published in the May issue and will describe the Apalachia Dam, which is one of the most interesting jobs now in progress. Future articles on other phases of the activities are planned and will be presented unless their publication is considered to be against the interests of national defense. However, one of the structures on which work is now getting underway is worthy of brief mention here because it will be the highest of its kind ever built east of the Mississippi River. It is Fontana Dam, which will be reared on property owned for the past 30 years by the Aluminum Company of America. It will rise 450 feet above the lowest foundation level and will contain 3,000,000 cubic yards of concrete. This is only a little less than the quantity in Boulder Dam and three times that in Norris Dam, the initial TVA dam. It will provide 1,500,000 acre-feet of floodwater storage and add approximately 200,000 kw. of installed generating capacity to the TVA system. It will cost around $50,000,000 and will be finished in 1944. As the site is in a section remote from other than scattered habitations, housing facilities will have to be provided for many of the 3,000 workers that are expected to be employed. To unwater the dam site to permit excavating of the foundation, the Little Tennessee River will be diverted through a tunnel several thousand feet long and about 50 feet in diameter.

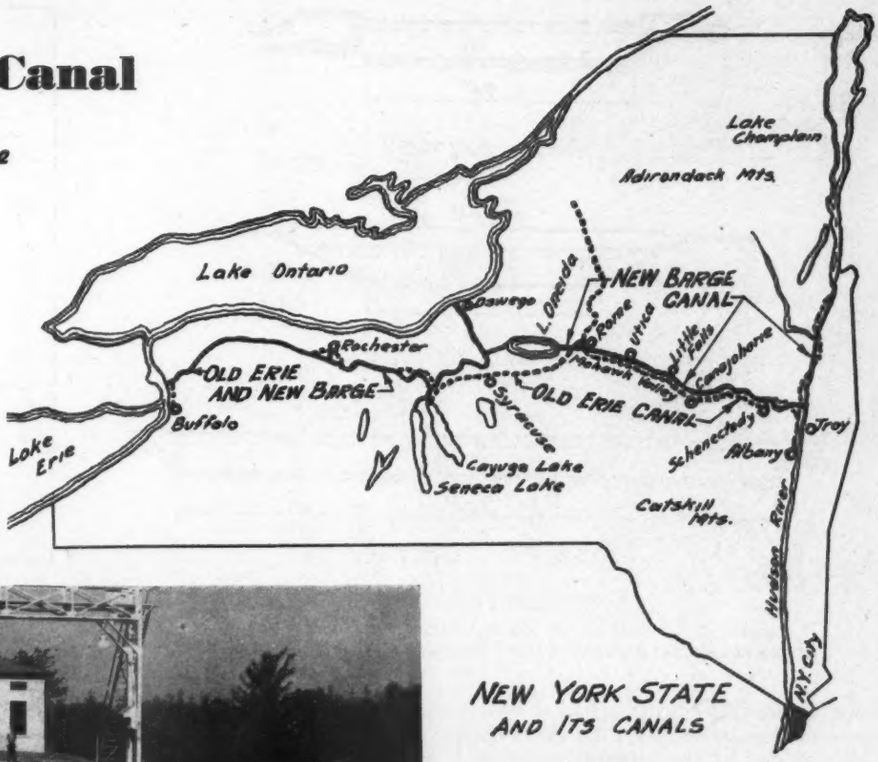
When all the dams now under construction are completed, the TVA river system, including the structures purchased and those that are to be operated by agreement with their owners, will be made up of 28 dams—nine on the main river and nineteen on its tributaries. An accompanying artist's sketch shows the locations of these structures and enables one to see at a glance how, together, they will provide for multiple use of the water for power generation and equalize the flow in the Tennessee to insure year-round navigation and to reduce floods of damaging proportions.

**HIWASSEE DAM**

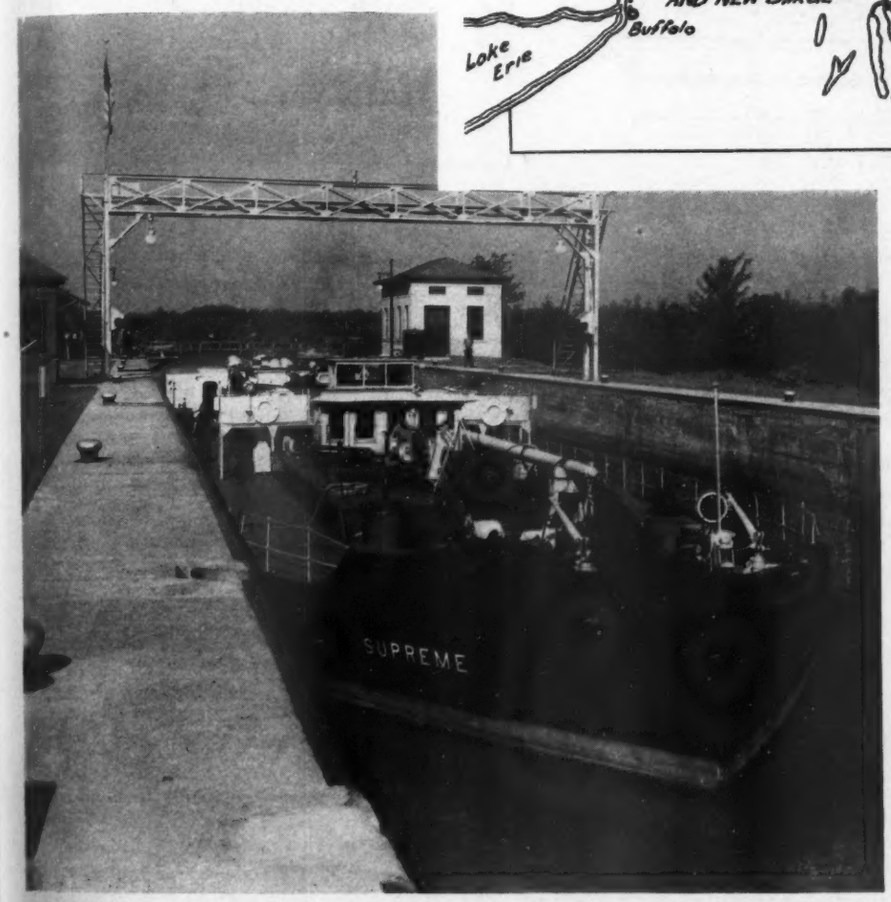
This structure on the Hiwassee River rises to a height of 307.5 feet and cost more than $17,000,000. It was started in 1936 and began producing power in May, 1940. Its reservoir has a controlled storage capacity of 365,000 acre-feet of water, which is available for increasing the flow of the Tennessee during periods of drought. Ten miles downstream from Hiwassee Dam there is now under construction the Apalachia Project, which will be described in our May issue. Including the structures that have been acquired from private power interests, the TVA will have eight dams in operation on the Hiwassee and its tributaries when the present building program is completed.

# Historic Erie Canal

Roy E. McFee




Photos from N. Y. State Dept. of Public Works




**CANAL SYSTEM AND LOCK**

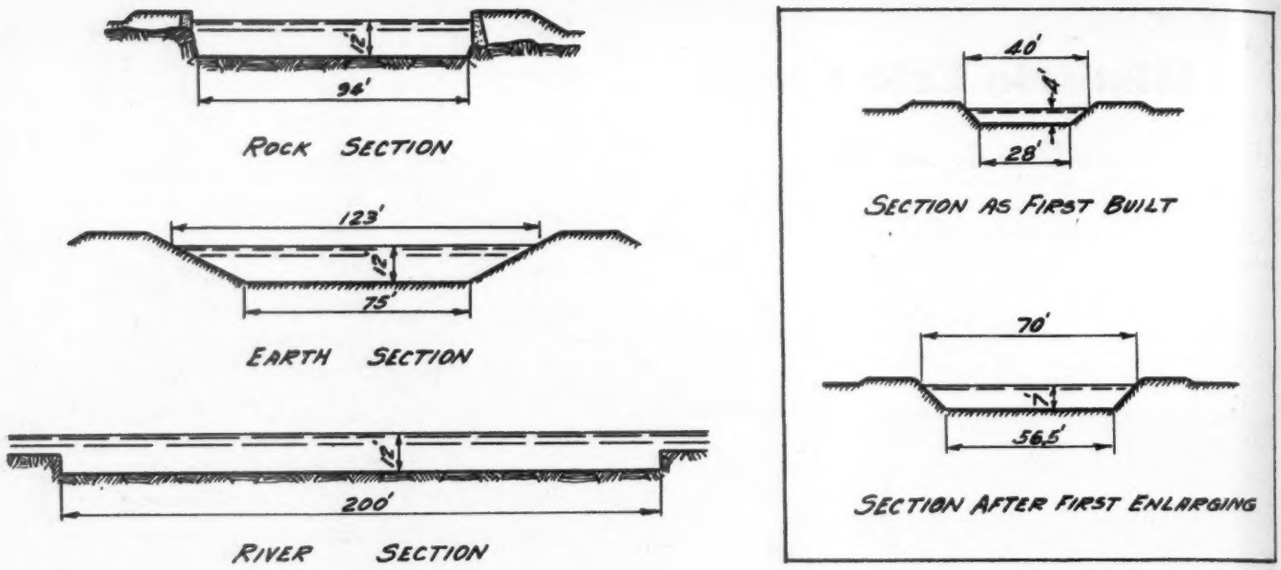
At the left is a steel motorboat passing through one of the locks of the New York State Barge Canal, successor to the Erie. The map shows the routes followed by the old and the new canal systems. The existing waterway represents total expenditures of more than $175,000,000. Since 1935 a program of improvement has been in progress and about $5,000,000 has been spent annually. This work, which includes widening the channel in earth sections and increasing the clearance of overhead structures to 20 feet, will probably be completed in 1943.

THE Erie Canal, in its heyday, was one of the sights of upstate New York. I have vivid boyhood recollections of it flowing through our farming region in the Mohawk Valley. At Canajoharie, our closest village, the famed ditch passed alongside a livery stable. Whenever I was fortunate enough to ride to town with my father, I always watched on the bank while he put the horses in the barn. Waiting there, a veritable stream of traffic was certain to parade before my delighted eyes. The drawbridge would lift with a warning bell, and then there would appear a string of boats drawn by a team of lazy mules on the towpath, or perhaps by a small tug. The barges would float slowly by, glide across a leaky aqueduct that spanned a creek, and would finally be lost to sight around a bend. That fleet was but one of a succession that continually moved through our cornfields, hop yards, and apple orchards for 90 years—decades during which the Erie Canal was vital to us. I was told that my grandparents had traveled by canal boat, and even in my day baled hay was still being loaded into barges docked at Canajoharie.

The Erie was a notable part of the landscape for at least six generations of our people. It was completed six years before the building of the first section of the New York Central Railroad, which now runs close along the same route. In eastern New York the waterway came to the rescue of the pioneers who had ventured into the rich agricultural lands ahead of any transportation facilities, but in western New York it blazed a trail through the wilderness—it was actually there before the arrival of the settlers. Its influence was immediate and lasting. Many a city today owes its importance to the fact that it was located on the Erie, and many a New York farmer even now is raising certain crops because the canal suddenly made them more profitable than others.

It is astonishing to learn that at the close of the Revolutionary War only three roads extended north and east from New York City and but one led west from Philadelphia. There were no bridges over the principal rivers. When turnpikes were finally built they were, for the greater part of the year, either dust or mud or impassable because of snow. Transportation was unbelievably slow and expensive. Stagecoaches literally crawled along, taking days for distances now covered in as many hours by train. To haul produce by wagon from Buffalo to New York City cost $100 a ton—usually more than its value when delivered.

Naturally, with such excessive transportation charges, there was little interchange between frontier farms and mar-




**DEVELOPMENT OF THE CANAL**

**The sketch at the right shows the sectional dimensions of the original Erie Canal. Above are similar sections of the Barge Canal, as completed in 1918.**

kets. Instead, the pioneers had to supply their own necessities with the aid, among other things, of the spinning wheel and the loom. It was the day of self-sufficiency on the farm—picturesque to look back upon but not profitable for the agriculturists nor for the Albany and New York merchants who wanted more trade. If the farmers could not get cash crops to market, obviously they could not buy from the cities.

Of the commodities that did reach markets, none was bulky. They consisted mostly of flour, corn meal, flaxseed, salted meats, grains, and potash. The production of potash was distinctly a frontier enterprise. In clearing the forest land, trees cut down were burned and the ashes collected. These were put into huge tubs, drenched with water, and the resulting liquid or lye was caught in iron kettles and boiled until a dark-gray ash remained. This was the potash of commerce and was exported to Europe for the making of soap and for other purposes.

Envisioning future growth and need, a canal through the Mohawk Valley had been suggested as early as 1724 by the surveyor-general of New York. The proposal was revived from time to time, and before the end of the century some locks were actually constructed in the lower Mohawk River. In 1810 the legislature of New York took action by appointing a commission to study the project. One member of that commission was De Witt Clinton whose name was destined to become imperishably associated with the canal. Clinton came of a prominent New York family. He was the son of a Revolutionary War general and the nephew of a governor, and was himself to be a United States senator and four times governor of New York. A graduate of Columbia University and a student of science and of public affairs, he recognized the importance of waterways as a means of transporting farm produce to seaports and carrying manufactured goods back to the hinterland.

The story goes that when Clinton first urged the canal he was asked how he proposed to run the water up and down the hills of New York State. He demonstrated by digging a trench with a spade, filling it with water, and thrusting wide shingles into the earth to serve as gates for locks. He thus showed that the canal not only could be made to climb hills but lift the boats over as well.

With the outbreak of the War of 1812 the project was overshadowed and not revived by Clinton until 1816. He himself was the author of the law which finally made it possible. In the summer of 1817, three days after becoming Governor of New York, Clinton signaled the beginning of the momentous undertaking by turning the first shovelful of earth at Rome. The middle section of the waterway was begun first, for various reasons. Being one of the high stretches of the route it was the easiest to build and had direct access to the feeder streams. Furthermore, when finished, it would provide local transportation while the other sections were under construction and, if it proved to be successful, might tend to silence certain politicians who otherwise would oppose its completion.

The obstacles faced were considerable. There were few trained engineers in the country, and no excavating equipment as we known it today. There were no contracting organizations experienced in that type of work. And over the whole project hung the risk of fever from the swamps of central New York. From Rome, the ditch was dug in both directions. The construction force included 3,000 men, 500 horses, and 200 yoke of oxen. By early 1820 a stretch of nearly 100 miles had been finished from Utica westward and was immediately put in service. The eastern end was excavated next, so that by late 1823 the Erie Canal was in use from Albany to Rochester. Finally, in 1825, it was completed throughout its full length.

The waterway had numerous features that were little short of awe-inspiring. It had special aqueducts: two to allow it to cross the Lower Mohawk River, one to bridge Schoharie Creek, and still another —this one 750 feet long—to carry it over the Genesee River at Rochester. At Little Falls the channel had been cut through solid rock, a mile-long earth embankment crossed the Irondequoit Valley, and just east of Buffalo a series of locks raised the canal a last 60 feet to the level of Lake Erie.

The actual construction of the Erie was thus an engineering triumph. It had been built through rock, marsh, and wilderness from the Hudson River to Lake Erie, a distance of 360 miles. Originally, it was only 4 feet deep and 40 feet wide at the surface, and had 83 locks, each 90 feet long, to lift the barges from virtually sea level at the Hudson to the surface of Lake Erie, 570 feet above the sea. It cost $7,000,000, a staggering sum in those days.

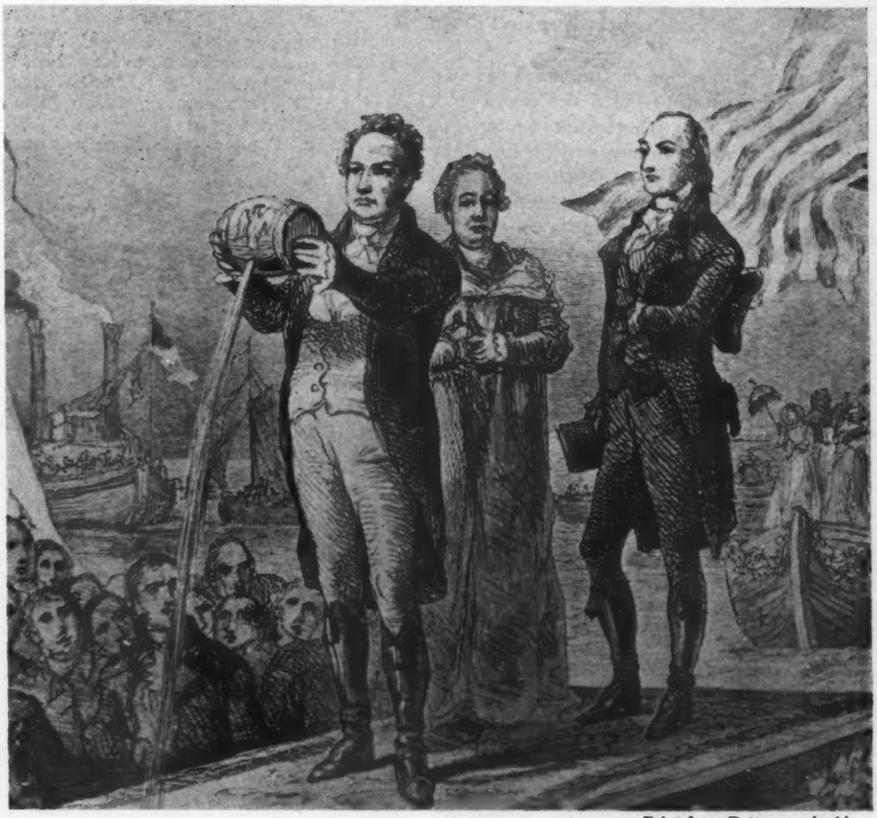
October of 1825 must have been a long-remembered month for our forefathers along the canal, for that month witnessed its opening with appropriate ceremonies. Cannon placed at intervals along the route flashed the news from Buffalo to New York City, covering the 500 miles in 100 minutes. A fleet of boats, led by the *Seneca Chief* with Governor Clinton on board, left Buffalo to ride the entire length of the Erie. On the way the party was given tremendous ovations in Rochester, Syracuse, Rome, Utica, Schenectady and Albany. But quite as impressive must have been the stretches between cities

through virgin forests, along grain fields and past countless farmhouses and barnyards. At Albany the steamer *Chancellor Livingston* took Clinton's vessel in tow for the trip down the Hudson. There the Governor was welcomed by twenty steamboats. Off Sandy Hook, he poured into the sea a keg of water from Lake Erie to commemorate, as he said, the union of the Great Lakes and New York Harbor.

The canal was popular at once. Indeed, even before through traffic was established the sections already finished were being used to capacity. In 1825, an average of 40 boats a day passed through Utica, carrying not only farm products but 1,000 men, women, and children. No less than 185,000 tons of freight, including wheat, lumber, and barreled flour, was moved in the eastward direction that year.

To handle the traffic, a new type of carrier was then developed for the service. The boats were 75 feet long, 14 feet wide, and had a draft of 2 feet 6 inches. They weighed 50 tons each and were hauled by two horses or mules at 2 miles an hour. The teams, of course, worked in shifts, so ample stable room had to be provided for them on the barges. When it was necessary to change animals, a boat would be brought to a stop along the towpath and a plank bridge pushed out to take aboard the tired team and to land the fresh one.

About this time tens of thousands of people began to migrate westward from New England and New York City by way of the canal route. This led to the operation of special passenger packets—lighter craft with comfortable sleeping quarters. These likewise were hauled by teams, traveling at the rate of 80 miles a day and covering the distance from Albany to Buffalo in 4½ days.



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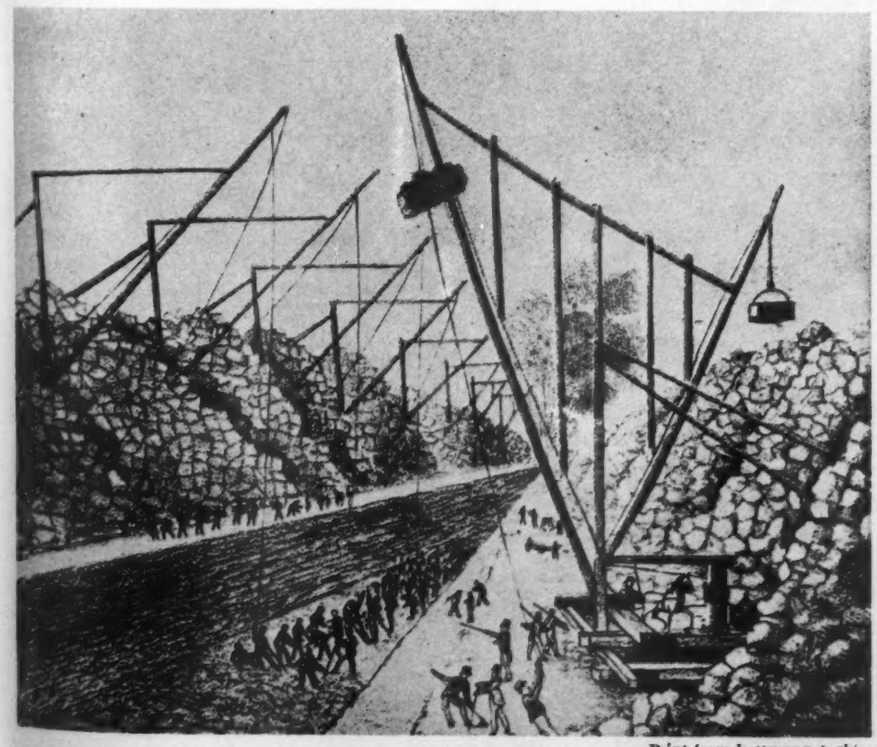
**WEDDING OF THE WATERS**

De Witt Clinton was such an ardent advocate of the Erie Canal that it was commonly referred to as "Clinton's Ditch." He was governor of New York State when the canal was completed and led the first party on a triumphant trip from Buffalo to New York in October, 1825. To commemorate the union of the Great Lakes and the Atlantic Ocean he poured a keg of Lake Erie water into the sea off Sandy Hook.



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**ORIGINAL-CONSTRUCTION SCENE**

This old print gives an idea of the methods by which materials were handled more than a century ago. Note the derrick operated by horsepower. The scene is Lockport, near Niagara Falls.

As was to be expected, farmers reaped substantial benefits. Freight from Buffalo to New York made the trip in eight instead of twenty days, and rates between those points dropped from $100 to $15 a ton. As a result, produce from the western part of New York State, as well as the arable land in the region, doubled in value, and the countryside for miles on either side of the canal began to prosper. From 1821 to 1835 the improved land in the state rose from 5,700,000 to 9,650,000 acres.

Quite as sensational were the changes in the kinds of crops grown. Until then the Hudson River Valley had been the center of the flour industry, but following the opening of the Erie it moved to the counties in western New York. The Mohawk Valley, which also had produced wheat and flour, turned to dairying and especially to the making of cheese. That situation has continued to this day, milk from that region being shipped to New York City every morning. Holstein-Friesian herds roam the fields that were once given over to the cultivation of wheat, creameries dot the riverfront, and the

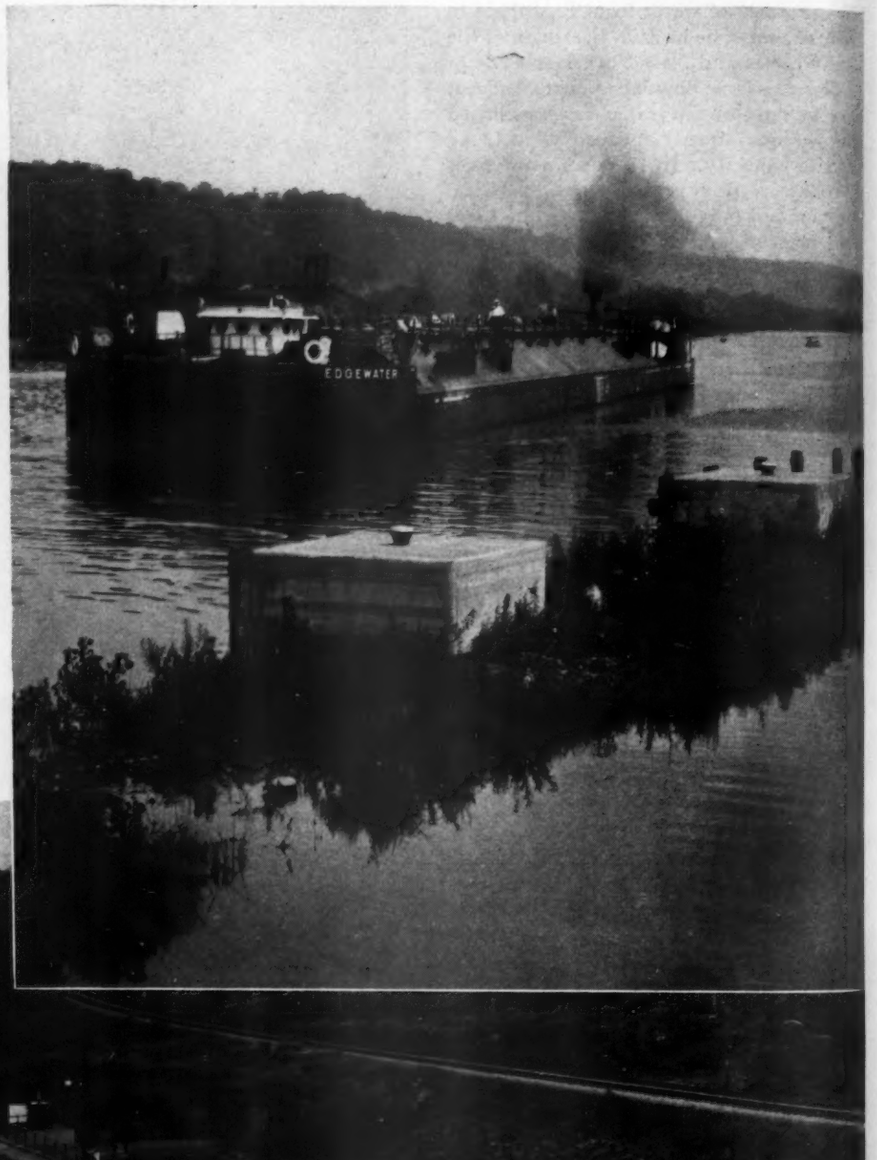
rattle of milk cans is heard up and down the valley.

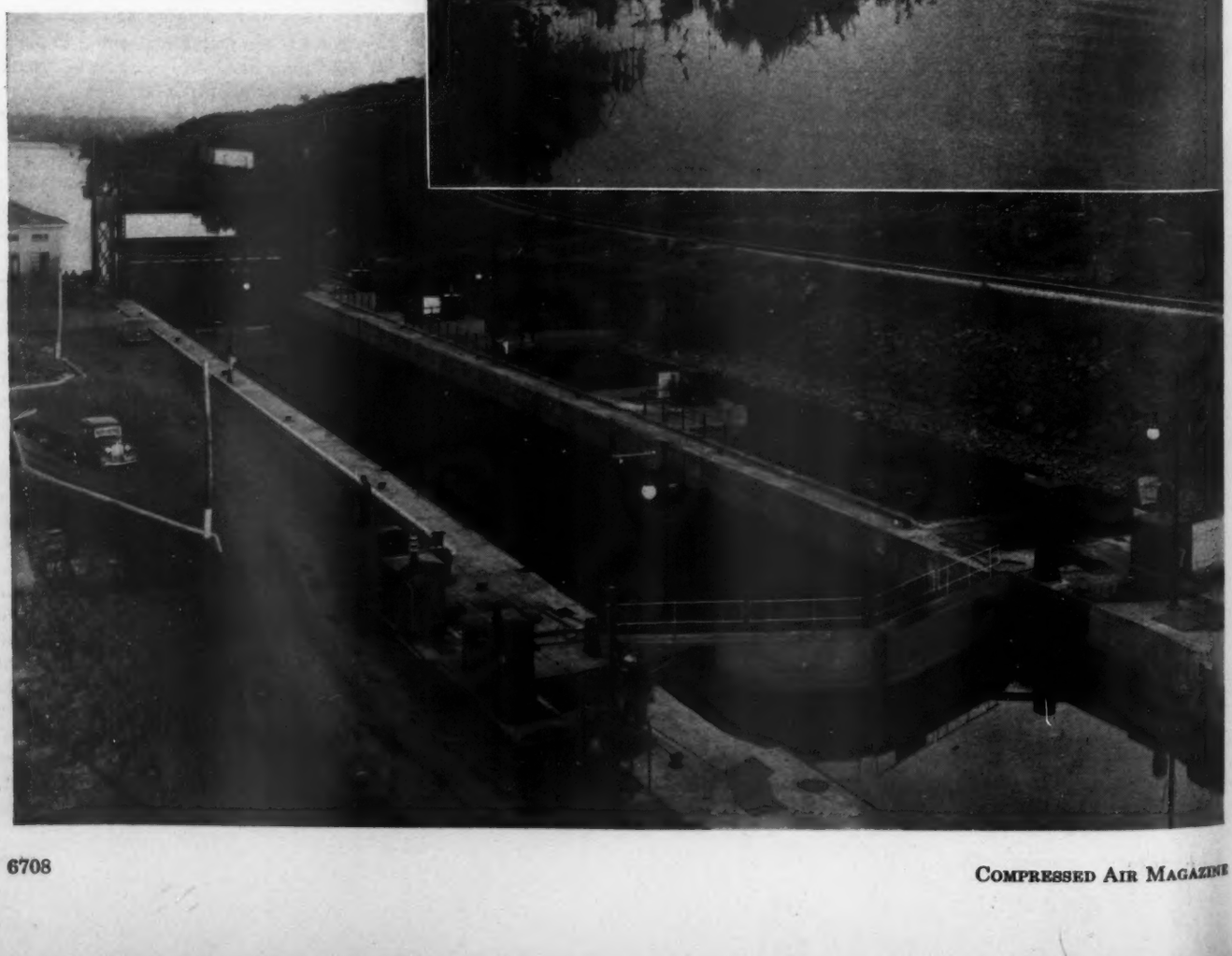
But the influence of the canal reached far beyond Buffalo—into the country of the Great Lakes where pioneer families were establishing homes and farms in the wilderness. Hardly was the waterway opened before Ohio pork was being hauled to Lake Erie, transported to Buffalo by steamboat or schooner, and then transferred to boats for the journey down the canal. As early as 1826 a 50-ton sloop brought a load of furs and potash all the way from Mackinaw, Mich., to New York City, a distance of more than 1,000 miles.

It was not long before the 4-foot channel was found to be inadequate. Ten years after the Erie Canal was opened for service it was decided to deepen it to 7 feet and to widen it to 70 feet at the surface. That work was finally completed in 1860, on the brink of the Civil War. In 1892, operations on still further deepening the channel—this time to 9 feet—were started but never concluded. Finally, in 1904, the State Government resolved to build the present Barge Canal System, and a comprehensive plan was laid out. It was proposed not only to reconstruct the old Erie, together with the short Champlain Canal, but also to provide two connecting links, one to Lakes Cayuga and Seneca of the Finger Lakes group and another to Lake Ontario, the latter affording a second route to the Great Lakes.

**OPEN CANAL AND HIGHEST-LIFT LOCK**

**The upper picture shows the motorship "Edgewater," a 300-foot steel vessel, en route from Detroit to New York with a 2,000-ton cargo. For the past several years approximately 5,000,000 tons of freight has been moved on the canal annually. Petroleum and its products make up about 35 per cent of the tonnage, with most of it going westward. Wheat is the leading commodity shipped eastward. The lock at Little Falls is seen at the bottom. It has a lift of 40.5 feet.**



**BARGE FLEET**

Although self-powered cargo vessels are now numerous on the canal, barges drawn by towboats still predominate. The largest vessel permitted on the canal is 300 feet long, 43.5 feet wide, and has a maximum height of 15.5 feet above water level. This is sufficient to enable it to navigate the Great Lakes and the coastal waters of the Atlantic. The boats are powered by diesel engines and have a carrying capacity of 2,000 tons. No toll is charged.

The ambitious project was begun. Steam shovels, dredges, and other heavy equipment, such as the old ditch had never known, worked on it until 1918. The main line along the original Erie is really an entirely new course. Beginning at the Hudson and running through the Mohawk Valley, the old channel along the south bank of the Mohawk River was abandoned for the deep water of the latter stream and, further on, for Wood Creek, with occasional stretches of independent channel. Crossing Oneida Lake, the route next parallels the Oneida, Seneca, and Clyde rivers, and is characterized by several more independent channels. The western section as far as Tonawanda Creek is an artificial waterway, and after that the canal follows that stream and the Niagara River to its terminus at Buffalo.

The new Barge Canal has shortened the run from 360 to 339 miles. It is 12 feet deep and has a minimum width of 75 feet in earth cuts, 94 feet in rock cuts, and 110 to 200 feet in rivers and lakes. The 83 locks in the Erie have given way to 35 larger ones, the highest of which—40½ feet—is at Little Falls. These locks have a usable length and width of 300 feet and 45 feet, respectively. Although the system was opened in the spring of 1918, less than a quarter of a century ago, work is already in progress involving the deepening and widening of the channel from the Hudson to Lake Oneida and thence to Lake Ontario, a distance of 185 miles. The project is being carried out with Federal funds and calls for a depth of 14 feet between locks and minimum widths of 104 feet in earth, 120 feet in rock, and 200 feet in rivers and lakes.

The entire character of the waterway was changed by the conversion of the Erie into the Barge Canal. The towpath is gone. Steel motorships now navigate it under their own power or that of tugs. They travel under speed restrictions at the rate of 6 miles an hour on the man-made sections and 10 miles an hour on the canalized rivers and lakes. The boats are driven by diesel engines and are built low enough to clear the 245 railroad and highway bridges that span the canal and yet have sufficient freeboard to breast the waves on the Great Lakes and even on the coastal waters of the Atlantic Ocean. They are 300 feet long, have a 10-foot draft, and have a carrying capacity of 2,000 tons. Many of them start as far away as Boston and Baltimore, whence they skirt the Atlantic Coast, move up the Hudson and through the canal to the Great Lakes, continuing westward to Detroit, Chicago, and even to Duluth.

Today, the Hudson River-Barge Canal benefits both farm and city. Along its route live 85 per cent of the men, women, and children of the State of New York and some of its richest farmland is in this belt. The waterway passes truck gardens in the fertile flats, at least one creamery in every township, and dairy and fruit-growing sections that reach far back into the uplands. During the 1940 season, 4,768,160 net tons of produce, ore, coal, etc., was transported by way of the canal. Of this total, 1,924,834 tons was shipped eastward and 2,843,326 tons westward to inland markets.

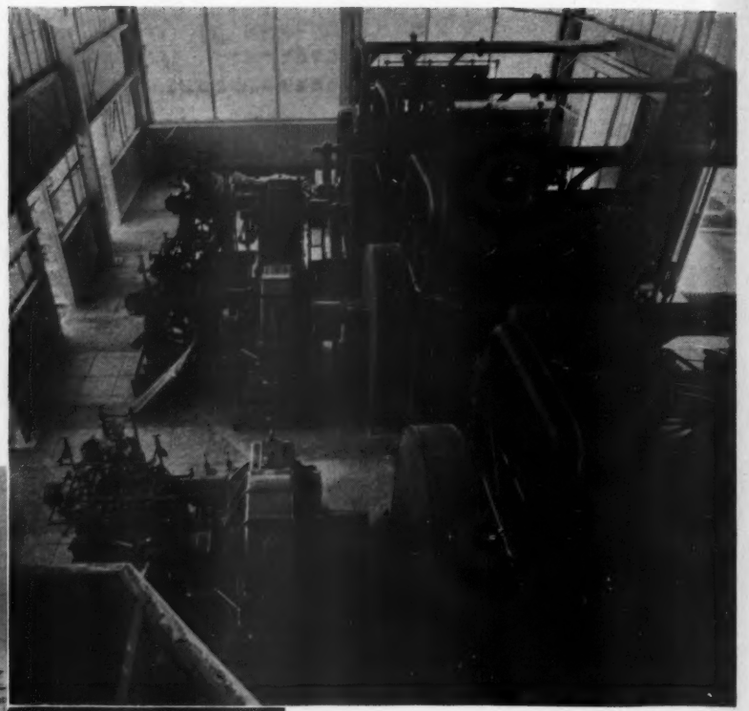
It is a long gap from the time the Erie was first suggested to the present canal system that represents the best in water transportation in New York State. It covers the period from the days when elm-bark canoes prowled on the darkened Mohawk while Indian villages frowned down from the hilltops—when the flatboats of our pioneer ancestors were floated in waters made deep by boulders placed at intervals across the stream—when the first canal boats were drawn by sleepy mules leaning against their harnesses. But now lighted motorships glide endlessly through broader channels, bringing a golden tide of commerce not only to the rural but likewise to the urban communities.

But the route of the famous old Erie Canal is not entirely lost to view. Wherever it has been altered, the original course can still be traced as it winds its way through the countryside. The towpath and channel banks are overgrown and tree-covered as they once were, and only crumbling walls remain to indicate the ditch that formerly proudly bore the traffic of the Empire State.

# New Oil Pipe Line Speedily Built

*W. H. O'Connell*

photos by M. D. Lanfre



**VENTURA PLANT AND PUMPING UNITS**

A general view of the Ventura pumping station is shown above. Inside (right) are four 4-stage Ingersoll-Rand pumps each of which is driven by a 6-cylinder, 275-hp., Type PVG gas engine and can handle 22,000 barrels of oil a day.

FOR speed of laying, the new Shell Oil Company pipe line between the Ventura field and the Wilmington refinery in California is an outstanding example of construction jobs of this kind. This 83-mile, 10-inch line was completed in less than two months and releases at least two tankers for service elsewhere. Work on the project was started on August 4, 1941, and on October 12 the line was put in partial operation. Since January 7, 1942, it has been delivering its rated capacity of 40,000 barrels of crude oil a day.

Noted for its contrasts, the California terrain traversed proved no exception to the rule. Starting at Ventura, the line passes over the surrounding cliffs, through fruit and nut orchards, farms and cattle ranches, and the property of a motion-picture studio before reaching the Santa Monica Mountains. Beyond that range it extends under 7 miles of paved streets in the City of Santa Monica, parallels the California State Highway to El Segundo and then the Santa Fe Railroad, and, several miles south of Los Angeles, encounters one of the highly developed residential districts surrounding that metropolis. The conditions prevailing there more or less continue the remainder of the way to Wilmington, the terminus. In all, 54 railroads and major highways had to be crossed without disturbing traffic. Most of these were in the Los Angeles vicinity, where the work involved much tunneling and boring.

The 10-mile stretch through the Santa Monica Mountains was by far the most difficult section of the route. There the contractor faced a number of problems because of the many V-shaped ravines that had to be negotiated. In some of these the line drops sharply down a 45° slope to an abrupt upturn at the bottom, only to climb up the other side on an equally steep gradient. Into regions such as this, which were not accessible by trucks, the pipe was carried by special platform tractors; but even these were useless at Mandeville Canyon, the most precipitous point in the Santa Monica section. There, for a distance of 1,400 feet, the pipe was pulled and eased into position by the aid of winches. As many as 150 bends per mile of pipe were required in this area, and most of these were made cold by means of side-boom tractors. Minimum-radius or 8-foot bends were shop made and delivered with the regular pipe lengths.

Much of the soil along the line's right of way was known to be corrosive, and it was therefore decided to use precoated pipe throughout. All but 8 inches at each end of a unit was covered with mastic, ½ inch thick, based on a specially prepared air-blown asphalt that gives the compound exceptional toughness and resiliency. With the sections welded together and bent to conform to the contours of the ground, the joints were similarly protected. This was done by pouring the hot mastic into molds that were clamped tight around the pipe to assure an impervious film.

Great care was necessary, particularly in the densely overgrown mountainous region, in handling the pipe, which was made up of 40- to 45-foot lengths weighing approximately 40.5 pounds per foot. Those familiar with pipe-line problems know that while a suitable coating will virtually prevent corrosion, a small unprotected spot in the line will be attacked and eaten through at a much faster rate—even a hundred times faster—than if the whole pipe were buried bare. Slings, straps, and sawdust-filled cushions were used in transporting the pipe to the points of placement, and a thorough check was made of the mastic coat before the line was progressively laid and the trench backfilled. So well was this phase of the work accomplished that delays attributable to resurfacing damaged sections before lower-

ing them in the ditch were negligible.

That the entire line should be in place 60 days after operations were started speaks well for both the engineering department of the Shell Oil Company and for the contractor, the Macco-Robertson Pipeline Construction Company of Clearwater, Calif. Seven pipe-laying crews were set to work on the job at widely separated points, and at the peak of activities a total of 650 men was employed. While the pipe was advancing at the rate of 500 to 8,000 feet a day, depending upon the territory being traversed, (the average daily footage for all gangs was about 12,500), the main pumping station at Ventura was being rushed to completion so that partial delivery of oil could begin as soon as the line was ready for use. In that plant are installed four 4-stage Class RT Ingersoll-Rand centrifugal pumps which have been designed especially for pipe-line service. Each is operated by a 275-hp., 6-cylinder Type PVG gas engine that develops its rated power at 400 rpm. and drives its pump through 8.96:1 speed-increasing gear. The pump and gear are factory mounted on a common base plate, thus assuring precision alignment of all parts rotating at step-up speeds.

Each pump can handle 22,000 barrels of crude oil a day against a differential pressure of 500 pounds. Two of the units operating in series build up a line pressure of 1,000 pounds, which is sufficient to send 25,000 barrels a day through the entire 83-mile system. Together with the two pumps in the intermediate station at Canejo, 40,000 barrels a day—the line's rated capacity—is delivered to the Wilmington refinery. The two Canejo units are larger but otherwise similar to those in the Ventura Station. Each consists of a 4-stage I-R Class 6-RT centrifugal pump driven by a 485-hp. PLVG gas engine that develops its rated power at 300 rpm. and uses Westinghouse speed-increasing gear on a ratio of 11.8 to 1.

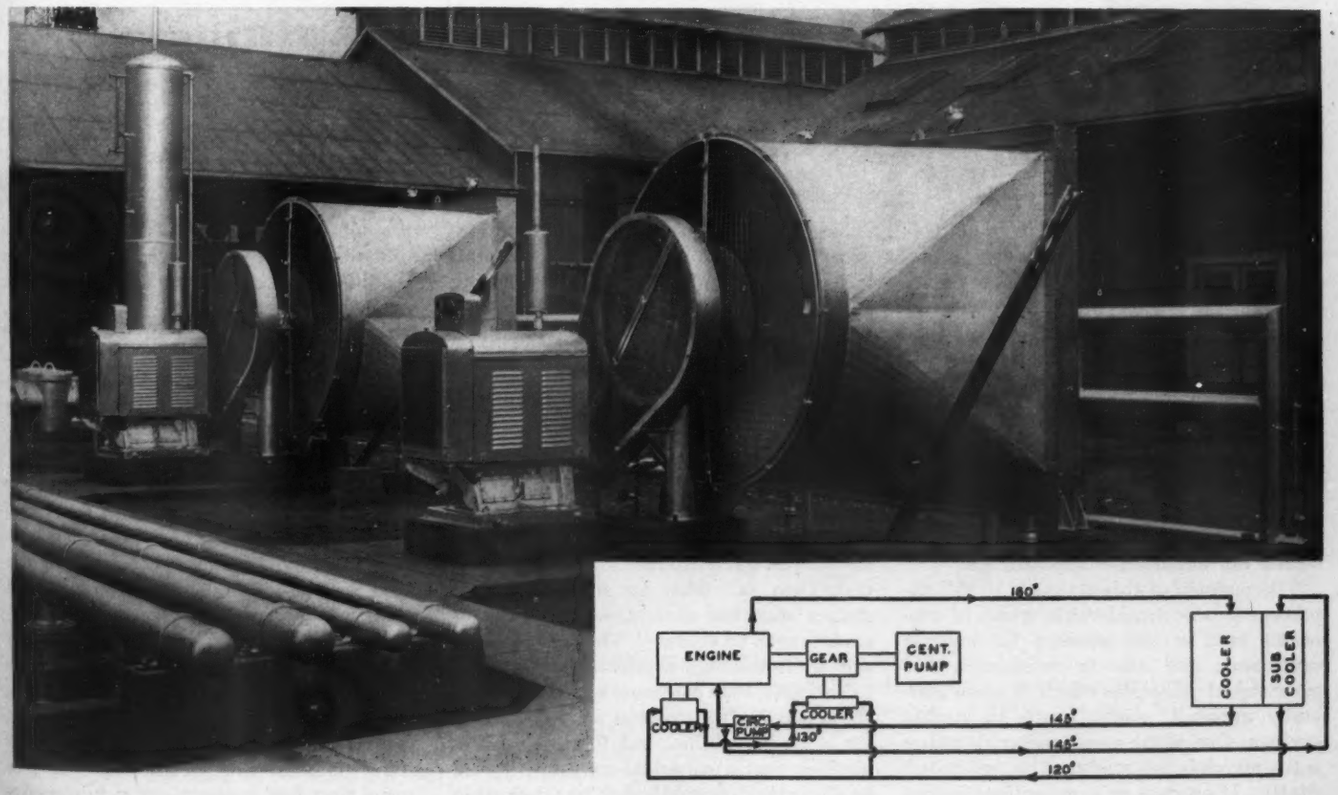
Following modern oil-field practice, the power units at the Ventura Station were installed before the erection of the building. Because the site selected for it was known to have numerous underground springs, the foundation block for the pumps was carried some 8 feet down to bedrock. Most of the excavating for it was done below water, for the water table came to within 2 feet of the surface, necessitating pumping from the time the forms were placed until the concrete had set. The concrete-lined pipe trenches also were affected by the ground water. To stabilize them, they were made extremely heavy and were tied to the engine-foundation block with reinforced-concrete beams. Most of the piping outside of the station lies in open trenches and is provided with manifold headers that make for considerable flexibility in the use of the pumping units.

A closed cooling-water circuit was chosen for the Ventura Station, and a novel system for reducing the temperature of the water coming from the engine jackets was installed outside of the structure. It was designed by engineers of the Shell Oil Company and consists of conventional radiators cooled by blasts of air from propeller-type fans. Two-stage cooling of some of the water is effected by passing it through a separate section of each radiator. This is necessary to supply a small quantity of colder water for cooling the crankcase and the step-up-gear oil. The accompanying diagram shows how this is done with but a single circulating pump for each pair of engines.

Thorough planning on the part of the Shell engineering department and well-organized prosecution of the work by the J. B. Gill Corporation of Long Beach, Calif., brought the Ventura Station to a state of readiness for service within the scheduled time. Less than 60 days after it was put under construction it began to deliver 25,000 barrels daily, and continued to operate at that capacity until the intermediate station at Canejo was completed.

## COOLERS FOR ENGINE CIRCULATING WATER

Two separate circuits are provided for the water used to cool the engines in the Ventura plant. Water coming from the engine cylinder jackets at a temperature of 160°F. flows through the larger of two compartments of either of two radiators outside the building and is cooled to 145° by a blast of air from a propeller-type fan. Most of the stream is pumped to the engine cylinder, but some of it is returned and passed through the smaller radiator compartment where it is further cooled to 120°. This colder water serves to cool the crankcase oil and the step-up-gear oil. It emerges at 130° and joins the stream of 145° water going to the engine jackets. A schematic diagram of this circulating system (from Oil and Gas Journal) appears at the bottom



Center Illustration from Continental Can Company. Others from Food Industries.

**VARIED TYPES OF CONTAINERS**

So-called tin cans (left) have, until recently, been made in almost numberless sizes and shapes. As the accompanying article points out, many of them are wasteful of material, although other considerations make them suitable for their individual purposes. Some dairies now offer 2- and 4-quart containers of milk (above), thereby effecting savings that are passed on to customers. However, many families do not have need for the larger quantity, and the bigger bottles are admittedly heavier and more unwieldy. Bottles such as the one at the lower left have merchandising appeal but do not fit into a standardization program.

# Can We Standardize Containers?

*Harry H. Hatch*

STANDARDIZATION in manufacturing, if conducted properly, means economy and efficiency. One of its chief benefits is the elimination of any unnecessary waste of time, energy, and material. In these days, the scarcity of certain raw materials makes their efficient use through standardization more urgent than ever. This is fully as important as the substitution of alternate materials which often are not so well adapted for the purpose, and is much less drastic than completely shutting off scarce materials for nondefense applications.

The purpose of this article is to call attention to the considerable waste of materials used in this country for making containers, and also to consider a few geometrical principles which, if more generally adopted, might result in sizable savings. One of the scarce materials today is tin, which is not produced in the United States. It appears as a protective coating on so-called tin plate for the manufacture of tin cans. The amount of tin plate allotted for this purpose has been sharply cut; but we could make this tin plate go further by working on the shape and size of the cans. However, the problem is not confined to tin alone. It involves a variety of materials for all kinds of containers, boxes, crates, cartons, tanks, bottles, etc., which come in every conceivable shape and in widely varying dimensions.

As indicated, there are really two problems; one concerning the shape and one the size of the container. The first question, then, is: what are the geometrical shapes with the most favorable ratio of surface area to volume? The second question is: how does size effect this ratio? As to the first, it is common knowledge that the sphere has the smallest possible surface for a given volume, but it is also quite obvious that a spherical container would be altogether impractical. The fabrication of a spherical, hollow body presents more difficulties than any other form, and the handling of such things would be most awkward. (It might be noted, though, that the modern trend in water towers and in holders for oil and gasoline is towards spheroidal shapes; but in these cases it is probably due more to the fact that a spherical shell is stronger than any other of the same wall thickness.)

Confining ourselves, therefore, to the generally accepted shapes for food and other containers, we know that they generally have a circular or a rectangular cross section. (Some few are oval, but these will be ignored here.) Geometrically, we would speak of them as "regular prisms with rectangular base" and as "right circular cylinders." And, viewing them from the purely geometrical angle, we find that a cube and a cylinder of the same diameter and height are the two forms that best answer our requirements

—that is, are the ideal containers. It is interesting to note also that the cylinder is the better of the two. For equal volume, the surface area of the cylinder is only 92.3 per cent of that of the cube. (That of the sphere, incidentally, is 78.5 per cent!)

To illustrate the effect of any departure from the ideal shape, consider the accompanying table. The figures are set up for prismatic containers with rectangular base and of varying proportions and different heights, all of them having the same volume. The table brings out, first, the advantage of a square over any rectangular base. Second, it shows the bad effect of departing from the proper height, both flat and slender containers being uneconomical. Based on the table, sardine cans and cigar boxes stand condemned, and narrow, slender bottles are equally bad. In fact, it would seem that most of the containers in common use are uneconomical when judged from this purely theoretical viewpoint.

The case becomes even worse when we take "size of container" into account. In mathematical parlance, the volume increases with the cube, or the third power, and the surface area with the square of the linear dimensions. That means, for example, that an 8-inch cube would call for only one-half as much material per cubic inch of volume as a 4-inch cube. And it also means that, inherently, all small containers, whatever the shape, waste material and should be discontinued.

So much for theory! What about the practical aspect of the matter? Obviously, much more enters into the problem than economy of material. For instance, while cylindrical cans require less material than square ones, this advantage is largely offset by the space lost in stacking or packing them. This waste of space counts heavily in shipping and storing, and it follows the round cans right through to the kitchen shelves and the refrigerator. Then, take the matter of large versus small containers: the trade is forced to consider consumer demand, especially in canned goods subject to spoilage. The average family just doesn't eat half a gallon of tomatoes at one sitting. Again, consider the wasteful wine bottle: how nicely it fits the hand and how well it discharges the liquid without bubbling—all because of its slender shape and conical neck. Or, take the question of appearance. Would champagne taste the same out of a demijohn? Could sardines be packed in a cubical can, be removed from it, and retain any semblance to a fish?

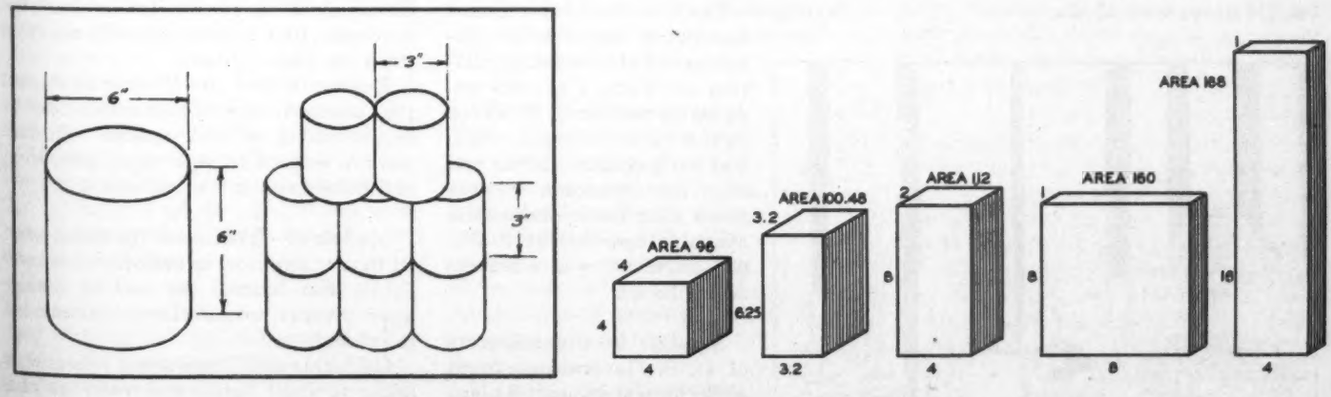
Going further, we must even admit that our theoretical premises are not too correct. For instance, in tin cans tin is used not only in plating the sheet from which the can is formed but also in the solder which seals the bottom, top, and seam along the side. The tin coating is less than one ten-thousandth of an inch thick; the layer of solder is much heavier. In fact, the solder in the average can contains more tin, in weight, than does the tin plate. That upsets all our previous speculations as to the best proportions for a tin can, for the higher a can of a given diameter, the less solder is required per unit of volume. Trying to figure the best height becomes, in fact, an involved operation. At a guess, a ratio of 1.5:1 for height to diameter, or even more, would now seem to represent the most favorable porportions, and, strangely, this checks not at all badly with prevalent practice for round cans.

All in all, geometry alone cannot decide the issue. Handiness, ease of packing and of shipment, customer requirements, established fashions and tradition, must be given their proper weight. Most important, existing manufacturing facilities, particularly tooling, will limit the scope of any attempt at standardization. Nevertheless, large savings may be effected solely by limiting sizes and shapes to a few basic numbers and by eliminating extremely small containers and all those that appeal only through oddity of design. Standardization along these lines has been accomplished in Great Britain and will, necessarily, take place here under the stress of war; but it will prove of equal and lasting benefit in times of peace.

SQUARE VERSUS RECTANGULAR BASE, SAME HEIGHT

| Base Inches | Height Inches | Volume Cu. In. | Area Sq. In. | Wasted Material Per Cent | Remarks |
|---|---|---|---|---|---|
| 4x4 | 4 | 64 | 96.0 | 0.0 | 4-inch cube |
| 5.66x2.83 | 4 | 64 | 99.9 | 3.8 | Rectangular base, sides 2:1 |
| 8x2 | 4 | 64 | 112.0 | 12.5 | Rectangular base, sides 4:1 |
| | | SQUARE BASE, VARIABLE HEIGHT | | | |
| 8x8 | 1 | 64 | 160.0 | 40.0 | Extremely flat |
| 5.66x5.66 | 2 | 64 | 109.3 | 12.1 | Moderately flat |
| 4x4 | 4 | 64 | 96.0 | 0.0 | Square |
| 2.83x2.83 | 8 | 64 | 106.5 | 9.8 | Slender |
| 2x2 | 16 | 64 | 136.0 | 29.4 | Extremely slender |

Since the foregoing article was written, standardization along the lines indicated has already been started. By orders of the War Productions Board, canned goods will now be offered only in a few specified sizes, and small containers are largely ruled out. For example, tomato juice, which came in as many as 35 different sizes and shapes, is now limited to four, the smallest one holding 12 ounces. Clearly, standardization of containers was long overdue.




**HOW DIMENSIONS AFFECT MATERIAL REQUIRED**

In the left-hand illustration, the single can has the same volume as the eight containers right of it. The latter have an aggregate area 56.54 square inches greater than that of the single can and consequently require that much more tinplate. In addition, they call for more solder, as well as increased time and labor to fabricate them, and take up considerably more room in storage or shipment. Each of the five geometrical figures at the right has a volume of 64 units. It will be noticed, however, that the respective sizes vary greatly in surface area and therefore in the matter of quantity of material needed for their manufacture.

# Log of Our War Economy

THE following paragraphs contain significant bits of information culled from official press releases sent out by the War Production Board.

FEBRUARY 26—Rubber thread for making corsets, girdles, brassieres, and other women's foundation garments is "out" for the war period.

The War Production Board reported that every 100 autos we are not making this year will furnish steel and rubber for four 27-ton tanks, tin for 100,000 cans, aluminum for 1.3 fighter planes, brass for 240,000 cartridge cases for .30-caliber ammunition, 10,000 pounds of nickel steel for armor plate, plus substantial amounts of chromium, zinc, etc.

MARCH 2—A New England manufacturer of machines for tenderizing steak turned to war work. One of the last orders received was from Reykjavik, Iceland, where the machine was presumably wanted to make steaks more chewable for the United States forces stationed there.

MARCH 3—Simplification of men's and boy's wool suits and overcoats was ordered. No more full-dress or cutaway coats will be made after March 30. Extra trousers, cuffs on trousers, belts, and other appendages will be eliminated. Coat lengths, trouser widths, and other dimensions will be restricted. A 26 per cent saving of materials is expected to result.

Maximum prices were set on silk waste needed to make powder bags.

MARCH 4—A manufacturer of beer cans converted his plant to the making of oxygen cylinders for aircraft.

Hosiery makers were told they would get more rayon to replace silk and nylon. Of 3,000,000 dozen pairs of high-grade women's hose made in January, only 140,000 dozen were of silk.


"We got this outfit to make homes for our woodpeckers."

MARCH 5—Leon Henderson told a Senate committee that tires and many other rubber articles will be unavailable to the average civilian until 1945.

Manufacturers of athletic equipment were seen turning to reclaimed rubber as a substitute for latex. Serviceable tennis, squash, and baseballs were in sight, but no solution of the golf-ball problem has yet been found.

MARCH 6—Replacement of most of our tin containers by glass was forecast. The trend will be towards larger containers to save materials and to reduce the frequency of deliveries to consumers. Openings in containers will be smaller to conserve material used for closures.

Deliveries of new and used typewriters were stopped, pending completion of rationing plans. The order was amended the next day to permit loans of used typewriters to persons taking Civil Service examinations and to those whose own machines were undergoing repairs.

A movement was started to reduce the number of incandescent lamp sizes, which is now 2,500. Each bulb contains critical war materials.

Washington reported that we spent $97,100,000 a day on the war during February.

Violations of the price ceiling set on women's nylon hosiery were reported. Wholesalers were warned that infractions of the order might bring a $5,000 fine or a year in jail.

MARCH 7—The manufacture of radios and phonographs for civilian use was prohibited, effective April 22. Affected are 55 companies that employed 30,000 persons and turned out 13,000,000 radio sets in 1941. They used 2,100 tons of aluminum, 10,500 tons of copper, 280 tons of nickel, and 70,000 tons of steel.

MARCH 8—The War Production Board announced that a large percentage of the 95,000 population of York, Pa., was engaged in war work. The York Safe & Lock Company, which had hard sledding during and after the depression because many used bank vaults were available, now has $100,000,000 worth of war contracts on its books.

MARCH 9—Commitments of U. S. Government funds so far for war-industrial-plant expansions were given as $5,885,000,000.

The WPB said its aim was to freeze the existing feminine silhouette to prevent radical style changes that would outmode clothes now being worn or already cut.

MARCH 10—Production of cotton bags for agricultural and chemical products was ordered increased to alleviate the shortage in burlap bags. Manufacturers were limited to a 60-day supply of cloth and users to a 60-day supply of bags to speed distribution.

Explaining the necessity for sugar conservation, the OPM stated that every firing of a 16-inch gun requires the distilled product of one-fifth of an acre of sugar cane. Every pound of smokeless powder involves the use of the alcohol derived from nine-tenths of a pound of sugar. It was estimated that, under sugar rationing, the stamps tendered by consumers to retailers will fill weekly up to 2,500,000 cards, each containing 100 stamps.

A ceiling was placed on the wholesale prices of 90 per cent of the nation's pork products. The American public consumed $2,000,000,000 worth of hog products in 1941. On February 15, the average farm price of hogs per 100 pounds was 15.2 times that of corn per bushel, as compared with a 32-year average of 11.6 times. Lend-lease buying will take 20 per cent of our pork production this year. Every man in our army eats 254 pounds of meat a year, one third of it pork.

Owners of 1939 to 1941 models of sound projectors for showing 16-mm. films were asked to offer them for sale to the Government for use in teaching service men and defense workers. A total of 35,000 of these machines was sold.

MARCH 11—The baking industry was asked to meet to consider reductions in the use of sugar, cocoanut oil, and waxed papers, as well as the curtailment of deliveries to save tires and gasoline.

The sale of sextants other than to the Government is prohibited unless the purchaser first obtains a certificate from the U.S. Coast Guard.

Dealers in floor coverings were warned that excessive inventories might lead to requisitioning of their stocks. Curtailment is desired to save wool, jute, cork, and other critical war materials.

MARCH 12—The metal rhodium, needed to coat reflectors in antiaircraft searchlights, was banned for use on jewelry after present manufacturers' stocks are exhausted.

California and Texas sheep raisers were asked to shear lambs and yearlings at a time when their skins would contain just the right amount of wool for making them into flying suits for our air force. To avoid the necessity of trimming, the wool should be not more than 1 inch long.

A list of twenty metals, twenty chem-

icals, and twenty miscellaneous materials that are vitally needed for war purposes was announced, and the public was informed that civilian industry must largely find substitutes for them.

Motorists were appealed to to turn in as scrap all tires that are so worn as to be no longer serviceable. Farmers are believed to have considerable stocks of such casings.

The public was asked to reclaim discarded bristle brushes, especially paint brushes. Most brushes use bristles from shaggy Indian and Chinese hogs. The American packing industry is investigating the possibility of getting longer bristles from American hogs. It was announced that plastic brush handles would be eliminated in favor of wood.

It was stated that the Government was considering halting the production of all domestic washing machines, but that parts would not be included.

MARCH 13—Dexter M. Keezer of the OPM asked the railroads to absorb the extra expenses incurred by wage increases and not to put in force the higher freight rates approved by the Interstate Commerce Commission.

Prices for finished piece goods made of cotton, rayon, and their mixture were frozen at levels prevailing between March 7 and 11. Such piece goods are largely used for women's and children's dresses and men's pajamas and shirts.

The manufacture of bicycles was curtailed to save critical war materials. Juvenile models were eliminated entirely. Of 1,800,000 bicycles made in this country last year, 85 per cent were for juveniles. Weights of bicycles were limited to 47 pounds, compared with an average weight of 57 pounds heretofore.

It was ordered that 80 per cent of the top-grade leather soles be set aside for military footwear. The present production of outersoles suitable for military shoes is 4,800,000 per month. Under the order, civilians will have access monthly to 640,000 top-grade soles and 4,000,000 outersoles of lower grades.

Conversion of automobile display rooms and repair shops into factories for war materials was urged. It was estimated that from 5,000 to 10,000 of the nation's 44,000 car dealers could thus weather the emergency. The prediction was made that 25,000,000 of the 30,000,000 cars now operating would be off the roads by the end of 1944.

Legal action was started against an Indiana auto-graveyard operator who refused "fair offers" for 150 tons of scrap metal. He demanded $22 a ton, while the Government fixed $18.75 as a fair price.

To stop runs on dealers' and suppliers' stocks, it was announced that reclaimed rubber is still available for making rubber heels, although the use of crude rubber is banned.

MARCH 14—War contractors were told that employment of women in increasing numbers was inescapable and that this would impose training problems which they should be prepared to meet. Women were declared to be safer workers than men.

The output of steel plates for February was 758,723 tons and set a new record despite the shortness of the month. March production was estimated at 800,000 tons.

Canners were ordered to set aside for Government requirements quantities of their vegetable and fruit packs ranging from 15 to 32 per cent of their 1942 production.

MARCH 15—Joseph B. Eastman, Director of Defense Transportation, said that increased railroad passenger business would make "travel as usual" more difficult in the months to come. He urged prospective vacationers and pleasure travelers to plan their trips well in advance to insure accommodations. No general rationing of rail or bus passenger tickets is now contemplated.

A 20 per cent cut in deliveries of gasoline to service stations in seventeen eastern states, the District of Columbia, Washington, and Oregon was ordered to become effective on March 19. Service-station operating hours were limited to twelve a day and 72 a week.

MARCH 16—By making some industrial alcohol from grain instead of from molasses, an annual saving equivalent to 550,000 tons of sugar will be effected, according to W. L. Batt, Director of Materials. Passage of pending legislation will permit redistillation of 140-proof alcohol from beverage distilleries to form a 190-proof product.

It was predicted that 50,000 automobile trailers would be produced this year. Virtually all of them will be used by war-project workers. Only 4,000 tires have been allotted the industry, and trailer dwellers will be expected to block up the cars and return the tires to permit the delivery of other units.

MARCH 17—Production of "juke boxes" or automatic phonographs after April 30 was barred. Last year, 30 companies turned out more than $75,000,000 worth of the machines and employed 10,000 persons. About a third of the plants have already been converted to war work.

MARCH 18—Typewriter production was curtailed to 325,000 standard and 75,000 portable machines during the remainder of the year, and distribution of all new machines was assumed by the Government. Last year's output was 730,000 standard and 530,000 portable units. Of this year's production approximately three-fourths will be reserved for Government use. The purpose of regulating the output is to hasten the conversion of manufacturing facilities to ordnance making.

It was ruled that after March 30 clothing retailers cannot put cuffs on men's trousers, but any stock on hand at that time with cuffs may be sold in that form. By eliminating cuffs, it is expected that enough material will be saved to make 300,000 suits.

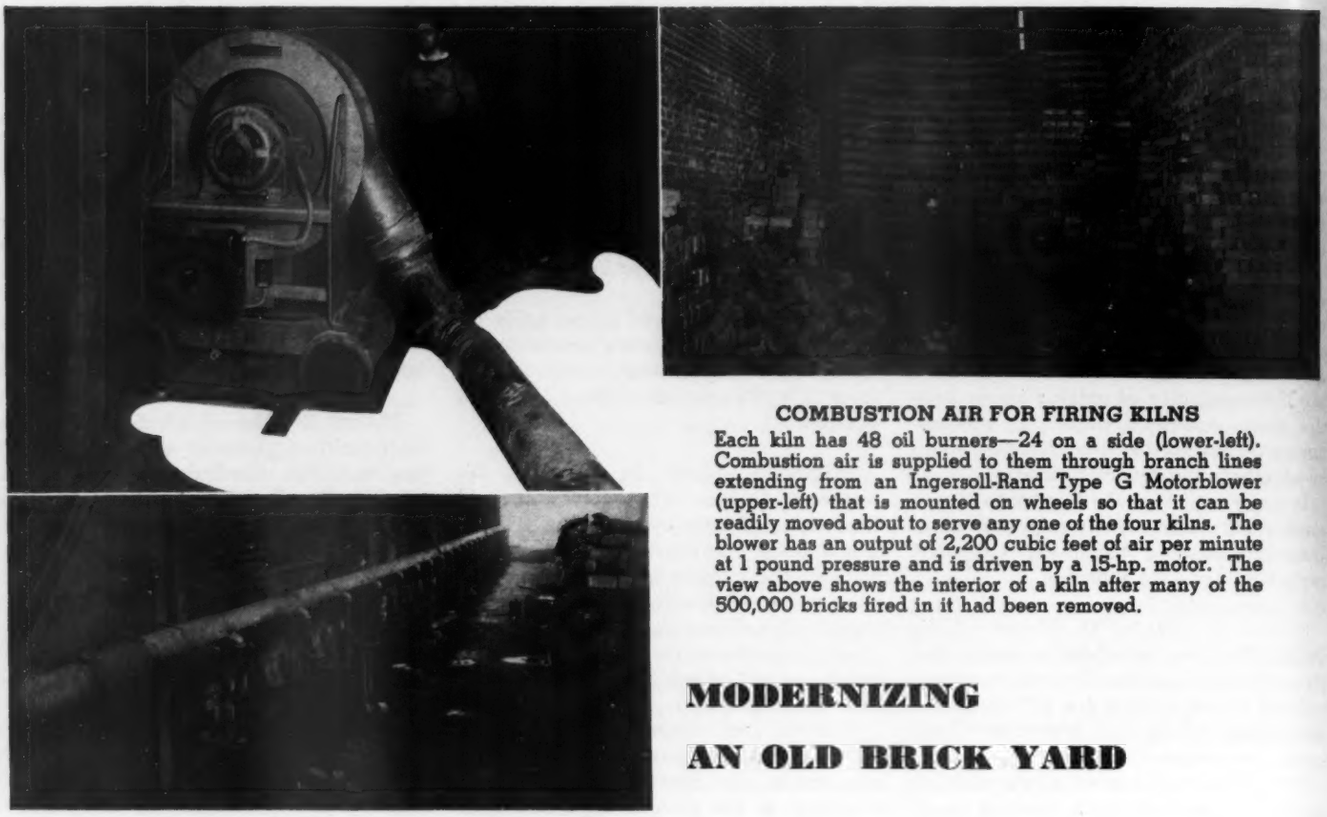
MARCH 20—Use of oils from which a high yield of glycerine can be obtained was curtailed. Included were cocoanut oil, babassu oil, and palm-kernel oil. All are largely imported and, because of shipping uncertainties, present stocks will be conserved to insure an ample supply of glycerine for war needs.

Beds, bedsprings, and mattresses will have about one-third less steel in them. The curtailment is expected to save 100,000 tons of steel a year.

Manufacturing jewelers were ordered to report immediately their inventories of tin and tin alloys. All such metal will be rounded up by the National Lead Company, acting for the Government. It is believed that from 1,000,000 to 1,500,000 pounds will be collected.

MARCH 21—It was reported that collections of scrap rubber fell off one-half after Pearl Harbor was attacked, the public showing a tendency to keep worn tires and other rubber objects formerly turned in. The country's rubber-reclaiming capacity is 350,000 tons annually, but it cannot be kept busy without scrap.

MARCH 22—Lake Superior iron-ore producers were urged to start lake shipments as quickly as weather conditions would permit. Approximately 90,000,000 tons of Lake Superior ore is wanted for steel furnaces this year—an increase of 10,000,000 tons over 1941. More than 95 per cent of it moves by water from Duluth to various Great Lakes points.



**COMBUSTION AIR FOR FIRING KILNS**

Each kiln has 48 oil burners—24 on a side (lower-left). Combustion air is supplied to them through branch lines extending from an Ingersoll-Rand Type G Motorblower (upper-left) that is mounted on wheels so that it can be readily moved about to serve any one of the four kilns. The blower has an output of 2,200 cubic feet of air per minute at 1 pound pressure and is driven by a 15-hp. motor. The view above shows the interior of a kiln after many of the 500,000 bricks fired in it had been removed.

# MODERNIZING AN OLD BRICK YARD

NEAR Matawan, N. J., is the Town of Cliffwood which, for more than 75 years, has been a source of manufactured brick that has found its way into many buildings throughout the eastern states. A large part of this section of New Jersey has rich reserves of clay which is peculiarly suited to the making of bricks. From one location in particular, the Oschwald Brick Works, Inc., is obtaining a clay that has certain self-burning properties which considerably reduce the amount of fuel required in the final kiln-firing of the product.

The site of the existing plant has been used for manufacturing brick for many years, and has seen the industry undergo many changes. Most of the many methods of production have been practiced there at one time or another, and in 1908, when the property was acquired by Joseph Oschwald—father of Paul Oschwald, the present owner—the soft-mud process was being employed there. Today the plant is almost completely mechanized. The older Oschwald employees recall when the work was highly seasonal. In those days dependence was placed on sun-drying, and the clay was mixed in pug mills powered by oxen and, later, by horses. Aside from the use of animals for that purpose and for transporting materials, practically every manufacturing step was a hand operation. Green bricks were made by skilled workmen who filled 9-brick molds with the mix and sliced off the surplus with hardwood cutting boards. The molds were carefully emptied and the soft bricks transferred to the open yard for drying. When the excess moisture had evaporated, the bricks were fired in small, narrow, coal-burning kilns.

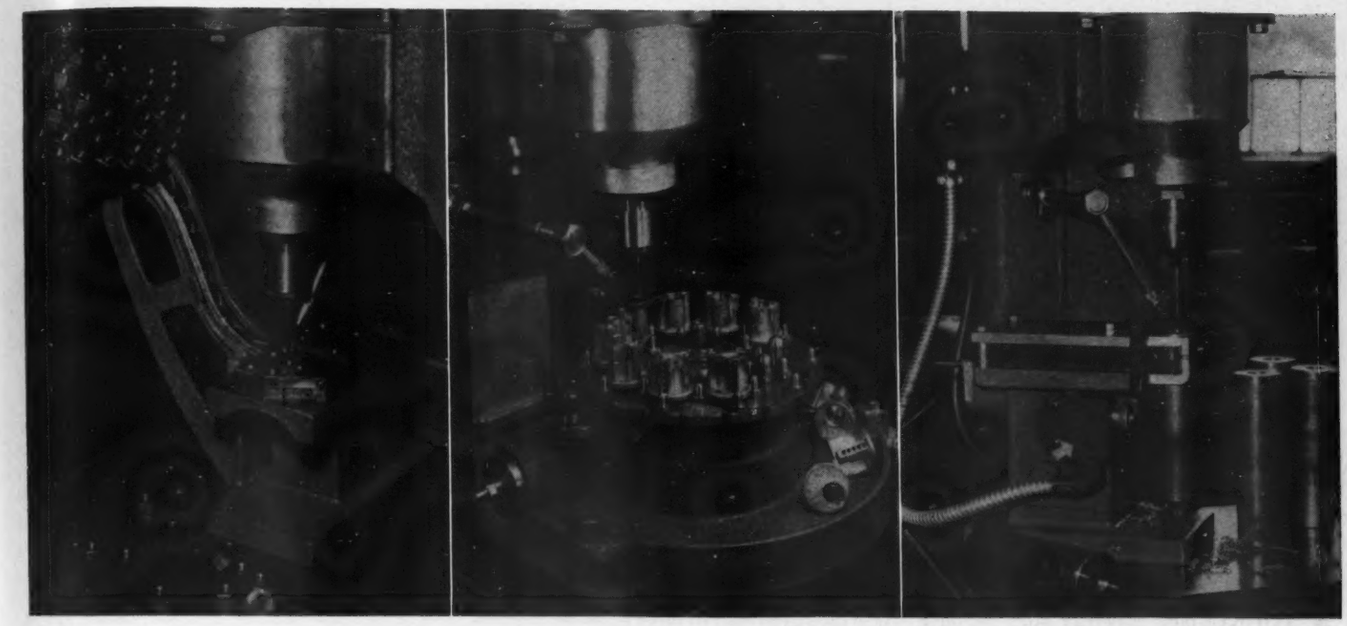
The first stage in the mechanization of the Oschwald works took place in 1914, when a steam-powered pug mill and Chambers Brothers stiff-mud, brick-making equipment were installed. These made it possible to produce green bricks at a much faster rate than the molders could turn them out by hand. Furthermore, because of the semidry nature of the mix, the bricks could be handled far more rapidly and with less spoilage. The uncertainties of open-yard drying also were eliminated at that time, for extensive steam-heated drying rooms were provided, and these accomplished in three or four days what it had taken weeks and sometimes months to do before.

Some ten years later, four large coal-burning kilns were built adjacent to the drying ovens. These were capable of firing 500,000 bricks each and have been in continuous use since they were put in service. The coal was burned on grates in pits which extended along both sides of the kilns. This more or less conventional method of supplying heat for firing gave way early in 1941 to an oil-burning system employing forced draft provided by a 15-hp., motor-driven blower that is mounted on a platform so that it can be moved from one kiln to another, as needed. The advantages of this arrangement are that one blower will serve all kilns and that the air piping can be kept as short as it would be if each kiln had a permanent or individual blower installation. Short piping tends to minimize leaks and to maintain constant air pressure at all burners.

In selecting low-pressure, oil-burning equipment, the operators were of the opinion that, in addition to eliminating the handling of both coal and ashes, fuel savings would be effected because oil is completely consumed and burned only when required. In reviewing the operations of the Oschwald plant for the past year, during which more than 20,000,000 bricks were produced, Chief Engineer J. E. Farrell expressed himself completely satisfied with oil heat.

## Sulphur from Pyrites

CANADIAN pulp and paper mills are making themselves independent of imported sources of sulphur by means of pyrite furnaces. According to the U.S. Bureau of Mines, the possibility of using pyrites as a substitute was under consideration for more than ten years, and an experimental furnace was built in the St. Maurice Valley in 1930. The earlier ones were not very successful; but an improved type, designed for the St. Lawrence Paper Mills Company, Ltd., has now reached a stage where it is supplying a large part of the company's sulphur requirements. It is based on the Freeman flash-roasting process, and is the first commercial pyrite furnace for paper-mill service in Canada. A second one has recently been installed in the plant of E. B. Eddy Company, Ltd.



**DIFFERENT TYPES**

At the left is a magazine type of nut-holding fixture fed by a tray and chute. It is tapping ⅜ inch-16 mild-steel hexagonal nuts at the rate of 1,800 an hour. The work is spotted by means of an air cylinder in the base. In the center is a dial-feed fixture with the index plate designed for holding die-cast aluminum Yale lock bodies. In this case both the loading and unloading are done by hand. Note the built-in pneumatic cylinder at the rear-left of the master base. The picture at the right shows the Haskins vise fixture equipped with a "piece part control" mechanism, which is indicated by an arrow. Through the medium of the latter the tap head is caused to move downward automatically and to start the threading operation when the work is inserted in the vise jaws. The fixture is holding a 2-pound shell.

# Pneumatic Holding Fixtures Speed Tapping Operations

HOLDING fixtures are an important adjunct of tapping machines and differ widely in form and construction in accordance with the shape and size of the work. In the newest types developed for the Haskins air-operated tapping machine, compressed air serves either to feed the pieces to be threaded or to apply pressure to clamping devices. All the units have built-in pneumatic cylinders and are designed for the vertical tapping of a diversity of parts including nuts, die castings, odd-shaped stampings of metal or plastic materials, and tubing for radiator-valve bodies, shell cases, and the like, the work determining the type of fixture to be used.

In the case of small pieces such as nuts, the positioning of the blank under the tap head, threading, and ejection of the finished part are entirely automatic. The holding fixture best suited for this purpose consists of a standard or master base, and of a tray and chute which vary with the size and style of nut to be tapped. Attached to the air cylinder housed in the base is a kicker bar that transfers the work from the bottom of the chute to the threading position, the stroke of the piston being synchronized with that of the tap-head piston through the medium of an automatic air valve, which is a part of the tapping machine.

Then there is what is known as the dial-feed fixture. Mounted on the master base of this unit is a horizontally disposed disk or index plate which differs in structural features with service requirements. This disk rotates clockwise through the medium of a V-shaped arm actuated by the pneumatic cylinder in the base. A pawl at the upper end of the arm engages the plate and holds it firmly until the tapping operation is completed. Then the air is exhausted from the cylinder and a tension spring returns the pawl to its normal position, after which the cycle automatically begins again. Disks with ten or twelve stations are considered standard and are loaded with one hand and unloaded with the other, or, where the work permits, it is ejected mechanically or allowed to drop through openings in the index plate.

One of the latest of the pneumatic holding fixtures developed by R. G. Haskins Company is a self-centering type of clamping device or vise. Compressed air is admitted to the air cylinder in its base, driving the piston forward and instantaneously closing the jaws on the part that is to be tapped. When pressure is released, coil springs return the piston to its normal position, opening the jaws. The action of the vise is under the control of the operator, who can adjust it for either single- or automatic, continuous-cycle tapping. Air at line pressure is applied except in the case of thin-wall tubing, when it is regulated to prevent crimping the metal, and the jaws are interchangeable to accommodate parts of varying diameters. For certain work such as threading shell cases, what is known as "piece part control" is used in conjunction with the clamping fixture. With the latter unit so equipped, the tapping cycle is started automatically by the insertion of the work in the jaws.

## Generators Save Power

UNDER present aircraft production schedules, millions of gallons of gasoline are consumed every month in testing the engines. They are given a shake down or green run for several hours and are then torn down, inspected, and reassembled for a final run. Both tests are made under load, and the power is expended in driving special propellers that serve no useful purpose. This is not only a wasteful practice but it also creates problems of noise and heat elimination. In the new Ford Motor Company plant the power is recovered and actually used to build the engines that develop it. This is done by driving generators instead of the propellers. When ready for a run, an engine is connected through the medium of a hydraulic slip coupling to a 1,250-kva., 720-rpm. synchronous generator which, in turn, is connected to the plant's common bus bar. When the engine speed exceeds 720 rpm. the generator operates at constant speed and delivers power to the system. There are sixteen generators in service, and they supply most of the power required to construct the engines.


### "Music Hath Charms....."

A YOUNG lady recently told us how she won a medal for speedy typing while attending business college. She had been ill for several days and was not aware that a contest was to be held until she walked into class one morning. She did not even have time to ask questions, so all she knew was that she was to copy as quickly and as accurately as possible some material handed her by the instructor. Under the circumstances, she didn't take the matter seriously. A phonograph record in a dancing school across the street was playing a ragtime tune and she was more intent upon it than upon her work. Almost without noticing what she was doing, she began hitting the keys in time with the music. Becoming absorbed in this little game, she forgot all about the contest and kept pecking away in unison with the tempo of the tune, which seemed to guide her fingers without effort. As you have already guessed, she was very much astonished to learn later that she had won the typing contest and, incidentally, an award of $25.

The foregoing incident is brought to mind by the report that large industrial companies are enlisting the aid of music to speed production of war materials. They have found that melodious strains, if "employed scientifically," will improve the morale of the workers by relieving monotony and so reducing fatigue. Save for the scientific angle, which includes, among other things, the selection of airs appropriate to the age, sex, and nationality of the workers, there is nothing new in this theory. As is pointed out by *The Miner*, a Vancouver, B.C., publication, many persons are familiar with the sea chanties that helped the mariners in the days of sail and hard manual labor. "The chanties," says *The Miner*, "were varied to suit the different tasks. Hauling chanties, for example, were written in a jerky rhythm to give the haulers the correct swing to their work and a chance to breathe between pulls, while capstan chanties were slow marches. If the ship was lucky enough to have a fiddler aboard, he often sat on the capstan and played while the men wheeled round and round him, singing as they pushed."

Negro labor gangs in the South have a habit of chanting as they toil, often improvising music and words to fit the timing of their movements. It is reported that Cuban cigar makers have long worked to music, which is varied from time to time with reading aloud from a book by members of a small group. As long as there have been soldiers they have marched to music, and anyone who has carried a full pack knows that tired legs respond to a tuneful air. Even mental effort seems to be stimulated by music, for many desk workers have the habit of whistling when they are deeply engrossed in brain gymnastics.

Some ten years ago a large manufacturer of radio sets instituted loudspeaker music in some departments. The experiment boosted production and reduced employee fatigue, and gradually other firms tried out the idea. Now, if we can believe what we read, many plants engaged in war work are seriously considering its adoption. One California concern that stresses employee comfort and well-being not only soothes their nerves with music at regular periods but also serves food. Instead of a clattering gong at eight in the morning, a time switch starts an automatic phonograph, and music goes through amplifiers to every part of the building. Other selections signalize the beginning and end of the noon hour. At the "fatigue point" in the afternoon there is a rest period. Fruit drinks and cookies in the summer and coffee and doughnuts in the winter are served at company expense. The day ends at five o'clock with more music. There are people, of course, who dislike music, although they are in the minority. Such poor souls, we fear, will have to carry a set of ear plugs to work if Uncle Sam gets serious about smiting the Axis with sharps and flats.

### Take Care of Air Hose

IN VIEW of the rubber shortage, it would seem to be unnecessary to caution users of rock drills and pneumatic tools to treat air hose kindly. It may be helpful, however, to point out specific ways in which the life of air hose may be prolonged. The admonitions that follow came from William S. Richardson, general manager of the Industrial Products Division of The B. F. Goodrich Company, and were contained in an article published in *Factory Management and Maintenance* for February. Mr. Richardson's ten commandments for the care of air hose are:

Buy the best grade of hose available, with the tube recommended to resist oil and heat and the cover to resist abrasion.

Select hose that has some firmness of body to help resist kinking and cracking.

Eliminate all preventable exposure to heat and oil.

Keep compressors in good repair and give special attention to aftercoolers.

Keep the hose cover free from oil.

Use care in handling the hose. Do not drag it over sharp objects.

Do not permit hose to catch on any object. It may be damaged or subjected to severe strain when an attempt is made to release it.

Do not use hose as a tow line to pull compressors or tools.

High-pressure-type couplings having clamps that fasten to the shank as well as to the hose give the best results.

When hose is not in use, store it in a cool, dry place.

The deterioration of natural rubber is hastened by exposure to sunlight, by contact with oil, gasoline, or grease, and by abrasion. Excessive heat or cold also affects the material, heat above 150°F. being especially harmful. Tension reduces the life of rubber, and air hose used intermittently will last longer than if it is in continual service. Contrary to common belief, rubber is not completely waterproof, therefore hose should not be allowed to remain long in water.

# This and That

**Golf Ball Divers**

Golf balls are going to be scarce this year and courses having water hazards are concerned over the possible loss of balls in them. Down in Florida three men with diving experience are turning their talents towards relieving the situation. The Professional Golfers Association has made an arrangement with them whereby their services as ball retrievers will be available to any club upon payment of a stated fee. The members of the salvage crew wear helmets that are supplied with air from a small gasoline-engine-driven compressor, and so equipped are able to comb the bottoms of ponds, bayous, or other water hazards and recover balls deposited there by erring golfers. It is estimated that the water holes of some links contain as many as 1,000,000 balls, while those of numerous others have up to 500,000. Although the balls are affected by a long stay underwater, they still are useful. They now command 12 to 15 cents each, as against three cents before the principal sources of raw rubber were cut off.

* * *

**Tailings Yield Mercury**

A recently patented process for extracting small quantities of mercury retained in tailings from mills treating gold and silver ores makes use of a stream of high-velocity air. The finely powdered tailings are introduced into the stream in the path of which are silver baffles. Because of its affinity for silver, the mercury adheres to the sheets while the mineral particles are carried on. When the globules of mercury attain sufficient size they drop into a collecting chute.

* * *

**De Luxe Tunnel Inspection**

The age of mechanization has exerted its influence on tunnel inspections. Short bores involve no great problem, but longer ones such as the Delaware Aqueduct sections are tiresome to travel on foot and casual water adds to the discomforts. Several attempts have been made in the past to devise a suitable vehicle to carry the principal engineers on final inspection trips, and with each successive effort improvements have been made. For the convenience of the group that had to pass approval on the 19-mile section of the Kensico-Hill View Tunnel constructed by S. A. Healy Company, the contractor provided a special conveyance that gave complete satisfaction. It consisted of a rebuilt Ford car and a trailer accommodating eight persons but used by as many as twelve. The Ford was shortened to permit it to turn around in the 19.5-foot bore and heightened to permit it to travel through 24 inches of water. The engineers sat in the trailer in comfort while the automobile headlights illuminated the tunnel walls for their inspection. The trip was made in four hours, and everybody finished with dry feet and no aching muscles.

* * *

**Touring Machine Tools**

A Michigan automobile plant shipped a group of multiple boring machines 25 years ago to an affiliated factory in Toledo, Ohio, where they were used for some years and then sent to Buffalo, N.Y. They served the Buffalo plant until it discontinued operations. The parent Michigan company recently contracted to make 75-mm. projectiles and needed some multiple boring machines. Inquiries revealed that new ones could not be obtained for three years, so the tool engineers started a still hunt for idle used ones. They spotted the equipment of a quarter-century ago, and now it has been moved back to its original location. The machines are being rebuilt at a cost greater than that paid for them originally, and will soon be helping to produce shells.

* * *

**Mining in a Park**

Phoenix, Ariz., claims to have the world's largest city park that has the further distinction of harboring a producing gold mine within its borders. Nearly 50 years ago a prospector named McCarty located a paying gold vein on the outskirts of Phoenix from which he is said to have taken $35,000 in ore before passing on to other fields. Sometime later the city established South Mountain Park, with an area of 14,675 acres. Virtually unnoticed inside of it was the old mining claim. Six years ago someone began digging around the open cut and found payrock. Since then the property has yielded $250,000 in gold. It is seldom noticed by the tourists who roam the park to see its cacti, Indian petroglyphs, and other attractions.

* * *

**Profits from Pigeons**

Reminiscences of John T. Beatty, who resided in Silver Reef and Frisco during the years that those Utah mining camps were in the boom stage, are contained in a recent publication by the Utah Writers' Project. Most of the miners carried six-guns and often wagered on their ability to shoot them. Blazing away at stationary objects grew tiresome, and they expressed a desire for moving targets. Mr. Beatty, who hauled wood to the camps, obliged them by obtaining a crate of pigeons. He sold the birds at 25 cents each and they were released, one at a time, as each contestant attempted to pot them on the wing. The pigeons were hard to hit and usually escaped unscathed. What the miners didn't know was that they were homing pigeons. By the time Beatty reached home they were already there. On his next trip with wood he would have another crate of pigeons for sale. A pigeon lasted almost indefinitely, and the income was steady.

* * *

**Lion and Lamb**

In ordinary times producers of aluminum and copper cable are competitors, but when war engulfed the nation two of the leading concerns in this field quickly forgot their individual interests. Following the Pearl Harbor attack, the Aluminum Company of America diverted most of its production to the airplane industry. One result was to render its cable-making equipment idle. Concurrently, the Anaconda Wire & Cable Company was called upon greatly to increase its output of copper cable. By means of a telephone call between executives of the two concerns it was arranged that the Aluminum Company should turn over to its competitor all available cable-making machinery, and at a price considerably below its original cost.

* * *

**Cash for Ideas**

That factory workers still have time to think under the accelerated program of war production is shown by the fact that more suggestions for speeding or improving methods were offered by General Electric Company employees in 1941 than during the previous year. The number submitted was 40,834, or 24 per cent more than the year before. For the 12,455 that were accepted, the company paid $95,203, as against $77,477 in 1940. Individual awards ranged as high as $800, ideas being remunerated on a basis of time or monetary savings. Nearly 70 per cent of the workers promoted to foremen during 1941 were frequent suggestion contributors. During the twenty years the suggestion plan has been in operation, G-E has paid employees more than $1,100,000. Most current winners take their awards in defense bonds.

* * *

**What's in a Name?**

A Frenchman who located a mine in Calaveras County, California, many years ago named it the *Camille*. He called at the registrar's office to record it and talked with a clerk whose knowledge of languages was meager. He wrote down the name as he understood it, and since then the property has been officially known as the *Cornmeal Mine*.

# Improved Air Clutch for Forging Machines

**FORGING MACHINE AND AIR CLUTCH**

At the left is a 5-inch Ajax forging machine equipped with the new air-cooled, air-operated clutch and built-in air receiver. The clutch shaft is carried by antifriction bearings at the rear of the machine (right) in capped housings which permit disassembly as a unit without requiring floor clearance for the full length of the shaft at either side of the machine. The location of the clutch above floor level without bothersome pits is of considerable advantage from the service standpoint. The arrows indicate the flow of the cooling air in and out of the clutch and flywheel.

A RECENT improvement incorporated in all forging machines and presses built by The Ajax Manufacturing Company is the double-draft ventilation which greatly increases the efficiency of the direct-acting air clutch by which they are operated. Air in great volumes is pulled in by scoops at the hub and on both sides of the flywheel, forced out centrifugally between the friction surfaces of the clutch plates, and discharged through openings in the outer clutch housing just inside the flywheel rim, as one of the accompanying pictures shows. This double draft assures generous circulation of air and cooling throughout the clutch, prevents excessive heating at highest frequency of engagement, and immeasurably prolongs the life of the friction surfaces.

The clutch, which was originated by the company, is housed within the flywheel. It is controlled by a foot valve which, by actuating a trip cylinder, first opens a valve to release the brake and then the clutch valve that admits compressed air to a pneumatic cylinder. Pressure is thus applied directly to the friction plates, clamping them together and starting the machine with a smooth cushioned action. To minimize piston travel and to assure instantaneous starting, the friction plates are assembled with small operating clearance, while minimum clearance volume in the cylinder above the piston and short direct piping from valve to clutch keep air consumption low, resulting in high volumetric efficiency. Oversized valves build up full piston pressure instantaneously, developing full clutch torque before the work is encountered. By the use of a regulating valve the air pressure at the clutch is maintained considerably below that in the shop line, in that way accurately limiting the torque capacity of the clutch and providing reliable overload protection for the forging machine.

## Laboratory Expedites Foundry Operations

TANKED oxygen, piped city gas, compressed air, vacuum, steam, and water are available at the turn of a faucet, thumbscrew, or valve, in the new steel-foundry laboratory of the General Electric Company. It is located in Schenectady in a fluorescent-lighted brick structure adjacent to the foundry and is equipped so that the latter can be furnished with a preliminary quantitative analysis of any steel sample within half an hour after it has been removed from a furnace. This involves testing the sample for its carbon, manganese, and molybdenum content so as to produce an alloy of the desired characteristics. Other elements present—silicon, sulphur, phosphorus, chromium, and nickel—are subsequently analyzed.

The carbon content of a sample is determined gravimetrically by means of three small electric furnaces with vacuum-tube controls. The steel is heated and oxygen is passed over it, causing a chemical reaction that results in a deposit of sodium carbonate in a test tube containing a known weight of caustic soda. The amount of the carbon is indicated by the increased weight of the test tube. A titration table with a battery of pressure-fed burettes is used to determine other elements that can be analyzed volumetrically. Solutions made from the samples are mixed with control solutions until certain color changes occur, the quantity of the latter added in each case to bring about the change indicating the amount of the element present. A daylight fluorescent screen behind the titration table facilitates color comparisons and burette-scale readings.

Precise weighing also is important in analyzing steels. This is done at the laboratory by balances that are accurate to within one three-hundred thousandths of an ounce and that give indirect readings to within one three-millionth of an ounce. They are in the center of the laboratory and mounted on a slate-covered, vibration-proof concrete pier. The latter has its footing 4 feet below the ground surface, has no point of contact with the building, and is surrounded by cork board that serves as a shock absorber. It is reported that as many as 145 quantitative analyses have been run in this up-to-date laboratory by two metallurgical chemists in a 24-hour stretch.

## Compressed Air Helps Clean Machine-Gun Barrels

BEFORE the barrel of each .50 Browning machine gun goes into final assembly, it must be proof-tested by discharging a 25 per cent overload cartridge. The latter has a primer containing chlorate of potash which, upon firing, is converted into potassium chloride. Inasmuch as the barrels are often placed in storage prior to actual use, it is necessary that the compound be entirely removed to prevent corrosion.

Heretofore the best available method of cleaning involved the use of an ammonia solution, which necessitated a 24-hour waiting period between operations. To speed the delivery of the gun barrels, it was decided to provide a substitute material that would eliminate those delays, as well as the ill effects of ammonia. After numerous metal cleaners, solvents, and oils had been tested, the research workers found that a variety of Houghto-Clean best answered the requirements. This substance contains a wetting-out agent that materially lowers the surface tension of the cleaning solution. With the adoption of Houghto-Clean, the procedure was simplified, and is as follows:

The barrel is clamped in a fixture which holds it in alignment with the piston of a 50-inch-stroke air cylinder and in a vertical position with the muzzle immersed in the solution. The latter contains from 6 to 8 ounces of Houghto-Clean per gallon of water and is maintained at a temperature of 180°F. Mounted on the piston rod is a phosphor-bronze brush. This is forced ten or twelve times through the bore, rubber washers above the brush acting as a sort of pump and lifting the cleaning solution into the barrel.


**MACHINE-GUN BARRELS**

After proof-firing with an overload cartridge, the bores are inspected, cleaned, and dipped in a grease-type compound that keeps the metal surfaces free from rust for a year and more.

After this operation, the barrel is clamped between rubber nozzles and rinsed for five minutes with a sal-soda solution (6 ounces per gallon of water). This mixture also is maintained at 180°F. Without changing its position, the barrel is next washed for ten seconds with water at 170°. The sal-soda solution is recirculated through the medium of a 25-gallon storage tank, while the water goes to a drain. After rinsing, the bore is dried with three small patches of Canton flannel which are pushed through it in turn by the aid of a pneumatic cylinder, any remaining moisture being vaporized by the heat in the barrel. The part is now dipped into Houghton Cosmoline at a temperature of 165°F. So treated, it is ready for packing and will resist the encroachment of rust or corrosion for a period of a year or more.

**PORTABLE VULCANIZER**

This tool is designed to lengthen the life of conveyor belts by keeping them in good condition. It serves to repair minor cuts and gouges in the rubber covering and thus prevents the infiltration of moisture and abrasives that would otherwise weaken the underlying fabric and cause breakdown. The Type RO vulcanizer can easily be handled by one man. It is made by The B.F. Goodrich Company.

## Resilient Plugs for Stemming Drill Holes

CHEAPER than dirt is how National Automotive Fibres, Inc., describes its Tampcot stemming for drill holes. It is in the form of resilient plugs 1½ inches in diameter and 6 inches long made of flameproof cotton batting that is not affected by freezing or moisture. The use of two plugs per hole is recommended, and will, it is claimed, save a stick of dynamite and result in better fragmentation and a noticeable reduction in after-blasting gases or fumes, to that extent improving the air at the working face. These advantages are attributed to the fact that the explosive gases are confined—have less avenue of escape than they would have under ordinary tamping, so that combustion is more complete and the shattering effect proportionately greater.

In mines where the use of Tampcot stemming is now standard practice, the records show that equally good and even better results are obtained with 35 and 40 per cent powder than formerly with 45 per cent dynamite. The plugs are packed for ease of handling underground in bags of 50, which weigh only 1 pound. A like number made up of paper bags and sand would weigh 75 pounds and more. Including the labor of filling, the latter cost about two cents apiece, according to estimates of mine superintendents. Tampcot plugs come to approximately 6/10 cent each. The company has announced that it is prepared to send a sample bag of 50 or 100 to potential customers free of charge.

# Industrial Notes

Hairpins are losing their kink as an economy measure. In the case of the so-called invisible ones it means a saving of about ½ inch of wire per pin.

A huge expansion of the Canadian nickel industry, involving an outlay in the neighborhood of $25,000,000, is in progress. The metal produced is to be turned over to the British, Canadian, and United States Governments for allocation.

Foot injuries caused by stepping on nails can be prevented, it is claimed, by using Goodall Rubberhide Safety Inner Soles. They are made to fit all boots and shoes and consist of a flexible steel sheet sandwiched between high-grade leather.

Many advantages are claimed for the portable pneumatic foot pedal designed by A. Schrader's Son for the operation of machines and presses. The device is shown in the lower half of the accompanying illustration, while a pedal of the conventional type is pictured in the upper half. It will be noted that a touch of the toe carries the former through its 1½-inch stroke, whereas the mechanical pedal, which has a 4-inch stroke, necessitates lifting the foot from the floor, thus throwing the full weight of the body on the other sometimes as often as 10,000 times a day. Because of this difference in stroke, and the ease with which the pneumatic pedal responds to slight pressure, users are not subjected to the resultant fatigue strain, and production is increased proportionately. As it can be placed at any comfortable angle and moved about, the unit can be depressed with either foot and with the operator in erect position even when the work is such that he cannot stand close to the machine. The Schrader pneumatic pedal can be built to fit any mechanical press.

By means of a net made to fit individual electroplating tanks, it is easy to recover work dropped from plating baskets or hooks. It is made of 6-thread twine woven into a material of ½-inch mesh that is not affected by nickel, cyanide-copper, Mazic-Zinc, acid-zinc, and cadmium solutions. The net is not suitable for alkaline cleaning baths and sodium-stannate solutions.

Sandblast hose of electrically conductive rubber is a new product of The B.F. Goodrich Company. It takes the place of the Anti-Static hose in which wire was counted upon to carry away the static charges. B.F.G., as it is designated, is of 4-ply construction with ¼-inch tube and ranges in size from ¾ inch to 3 inches.

Air-raid sirens that can be operated with compressed air or 425°F. steam at 50 to 250 pounds pressure are offered by the Foster Engineering Company. They are said to have an audible range of several miles and to reach their maximum pitch in from three to five seconds. Sound cut-off is sharp when the flow of air or steam is stopped by means of a brake mechanism, which likewise serves to prevent over-speeding of the rotor. The horn can be adjusted for speed and to give a constant or variable tone, making it suitable also for industrial signaling.

Galland-Henning Manufacturing Company announces its Nopak Hy-Pressure Hydraulic Valve, which is said to eliminate pressure-locking and the various troubles which stem from that condition. New features of design keep the hydraulic pressure always balanced within the valve; with the result that the lever operates as easily from the "on" as from the "neutral" position. This steps up production of high-pressure hydraulic machinery and subjects the operator to less fatigue even when the valve is manipulated rapidly for hours at a time. The Nopak valve is built in four sizes: ⅜, ½, ¾, and 1 inch.

Just off the press is a new 8-page, 2-color bulletin issued by The Eimco Corporation, Salt Lake City, Utah. Known as Bulletin No. 107, this profusely illustrated booklet contains descriptive highlights of two famous tunnel jobs, the Carlton at Cripple Creek, Colo., and the Elton near Salt Lake City. Many interesting statistics are included, in addition to data on loading costs. The Eimco-Finlay Loader and the Model 40 Tunneloader, both manufactured by The Eimco Corporation, are described in considerable detail. The former machine is operated entirely by compressed air, while the latter, having a greater capacity and clean-up range, is powered by either compressed air or electricity. The bulletin will be furnished free upon request.


**BLACKOUT LAMP**

Designed for indoor illumination in air raids, the new Wabash Blackout bulb casts a soft beam of orange light. The lamp has a pure-silver lining that hides all filament glare and projects the rays downward, as the picture shows. Light leaks are prevented by coating the bulb with a black silicate to the extreme end, which is a deep orange.

Deox-X is a new member of the Tocol Line produced by Protective Coatings, Inc. It is a metal conditioner for removing oil and rust, for preventing rust, and for preparing surfaces for finish coats of paint, lacquer, varnish, etc. Its use is said to make paint last much longer than it otherwise would. The fluid is suitable for ferrous and nonferrous metals, including galvanized sheets, is noninflammable and nontoxic, and can be applied hot or cold by dipping, brushing, or spraying.

Dried and fresh paint, varnish, shellac, asphalt, and kalsomine can be loosened and cleaned from brushes, it is claimed, by first immersing them in a liquid called Brush Cleaner and then by rinsing them in water. The solution is a product of Samuel Cabot, Inc., and is said to be non-

injurious to bristles and rubber settings, noncaustic, and noninflammable. It can also be used as a paint remover.

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Barrage balloons—small captive balloons that support wires or nets as a protection against air attacks—are inspected for leakage by inflating them with compressed air.

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It is estimated that the millions of tires and tubes now in active service in the United States would give automobilists around 7,000,000,000 more car-miles if the average speed of travel were reduced 10 miles an hour. So slow down to keep 'em rolling.

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Mr. Frederick S. Jones, who has for the past several years been chief engineer of the New England Division of the Socony-Vacuum Oil Company, Inc., with headquarters in Boston, has been transferred to the technical staff of the company's main office at 26 Broadway, New York, N. Y.

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Silver, of which there is no scarcity, is finding application in ordnance plants. Being resistant to corrosion, the metal is being used in varying amounts in the recoil mechanisms of artillery. In an 8-inch howitzer, or a 150-mm. gun, about 9.5 pounds are required for that purpose.

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Have your tires branded with your initials to discourage tire-rustling. It is reported that Firestone dealers are rendering the service free of charge and are using an electric tool that is designed to mark any combination of three letters on the side wall.

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*How Jackbits Reduce Rock-Drilling Costs* is the title of a 24-page bulletin that has been published by Ingersoll-Rand Company. It contains more than 50 illustrations, a table listing the types of bits recommended for different kinds of work, and gives cost data. Specific hard-rock jobs are described to show how I-R detachable bits and reconditioning equipment designed for them will benefit the user. Copies of the booklet—Form 2780—may be obtained free from the company's main office, 11 Broadway, New York City, or any of its branches.

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Coating ordinary window or plate glass on one side with Roxaneal—a new liquid lacquer sold by Roxalin Flexible Finishes, Inc., makes it shatterproof. It is further claimed that panes so treated do not obstruct vision or light and can be washed with a mild soap solution without affecting the protective film. When no longer required, it can be removed by the use of solvents or peeled off by means of razor blades. It is available in transparent or opaque form, the latter for blackout purposes.

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Laboratory work is being conducted by the Hudson Bay Mining & Smelting Company—largest zinc operator in the Province of Manitoba, Canada, looking towards the recovery of zinc in piles of tailings that are estimated to contain close to 300,000 tons of material running as high as 23 per cent zinc. The test process involves treatment of the residue with sodium chloride, which precipitates the greater part of the gold, silver, and copper. The remaining zinc, with iron and other impurities, is roasted and yields what is said to be virtually pure zinc oxide. If the experiments prove successful, the pilot plant will be replaced by one capable of meeting the needs of current operations.

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According to a recent announcement, the Hercules Powder Company has turned over to public use its patents covering the treatment of cement with Vinsol Resin to prevent surface and progressive scaling of concrete roads after repeated freezing and thawing. This pine-tar derivative, together with other fatty substances, has undergone exhaustive laboratory and field tests that have proved conclusively that the addition of as small a quantity as 0.03 to 0.05 per cent will produce a concrete that is highly resistant to the action of frost. It increases the cost of a barrel of cement by just a fraction of a cent and has been adopted by many cement manufacturers. Because of this generous step on the part of the Hercules Powder Company they are free to use Vinsol Resin without the payment of royalties.

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Primoid Standard is a waterproofing compound that is said to be an effective seal for concrete, brick, stone and other kinds of masonry, as well as for wood and composition materials such as shingles. The clear, rubber-base liquid is applied by brush or air spray and, according to the Primoid Products Corporation, penetrates deep into the pores, effectually sealing the surface and adhering permanently. It is suitable for rustproofing metals, and can be mixed with either dry colors or colors ground in oil.

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Because oily or greasy floors are slippery they are a menace to workmen. To prevent accidents, the Fisher Equipment Company is offering a dry, granular material that is said to have a high affinity for oil and grease and to absorb them within a few minutes or hours, depending upon conditions. It is sprinkled on the floor and swept away, leaving the floor clean. The compound is noninflammable and can at times be used again and again.

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With tungsten listed among the war metals, it is of interest to learn that the Hollinger Consolidated Gold Mining Company has announced the construction of a $50,000 mill at Timmins, Ont., for the recovery of scheelite from its ore. The mineral is found widely in Ontario and the Northwest Territories in small quantities which have not justified mining it for tungsten alone. In the case of Hollinger and other gold mines it has been obtained as a by-product. Now, with the demand for tungsten, and a mill available for treating scheelite ore, working of the scattered deposits will probably be justified. Actual refining of the product will be done at Ottawa in a small but modern plant operated by the Dominion Bureau of Mines.

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This 40-hp Type F5 Motorblower delivers 4400 cfm to cupolas in the T. Shriver & Company foundry.

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"Many of the castings for our filter presses are fairly difficult to make. The higher spout temperatures and the uniformly hot iron we now obtain with controlled blast have helped to improve our foundry practice.

"In installing the new equipment we were primarily interested in better control of the cupola, and hence of the products of the foundry. We are nevertheless pleased to note that by raising the iron to coke ratio from 8½:1 to 9½:1 *we are saving some 600 pounds of coke daily.* At current coke prices, this amounts to well over $1000 saved in a 300-day year."

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